

MANURES

OF

EVERY DESCRIPTION,

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 Book No. (05-8)
 Author Rutherford, H. H.
 Title Planter's' wh - Book

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RUTHERFORD'S PLANTERS NOTE BOOK

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OF USEFUL MEMORANDA FOR
EVERYONE CONNECTED WITH
THE PLANTING INDUSTRIES
OF THE MIDDLE EAST

SEVENTH EDITION

Price £1. (Rs. 15.)

PRINTED AND PUBLISHED BY THE
TIMES OF CEYLON COMPANY LTD.
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1918.

Preface to First Edition.

ALTHOUGH many excellent works have been published for the guidance of Tea Planters in this Colony, it has always been felt that no handy note-book was available for easy reference, concisely compiled, and unencumbered with irrelevant matter.

Persuaded by a few friends that such a note-book would supply a want if I published the results I had arrived at from my own experience, together with notes and information collected from other sources, I have ventured to lay this Note-Book before the Ceylon Tea Planter, and I do so with the hope that it may be found useful to him in his every-day work.

In a book such as this is there must necessarily be, in the compilation, a large amount of matter other than original. It therefore affords me much pleasure to acknowledge my indebtedness to many previous authors on Tea planting, and also to those Planters who have kindly assisted me with much useful information. There will be found a number of original tables and figures not previously published, and which, it is thought, will add greatly to the usefulness of the book.

H. K. RUTHERFORD.

NUWARA ELIYA, CEYLON.

31st March, 1887.

Preface to Seventh Edition.

THE sixth (1914) edition having received even greater support than its predecessors, the publication has been out of print for more than two years.

The whole work has been thoroughly revised and the principal new features are Chapters on :—

Rubber Diseases.

Care of Livestock.

Treatment of Anchylostomiasis.

The seventh (1918) edition is necessarily affected by the shadow of the great war now raging, and it is therefore impossible to give exact figures where the cost of materials are concerned.

We record our grateful appreciation of the assistance given by—

The Scientific Officers of the Rubber Growers Association; Messrs. K. G. Marsden, B.A. (Oxon), F.C.S., and A. T. Reeve, A.R.C.S., for their very valuable notes on the Common Diseases of *Hevea Brasiliensis* and their Treatment.

Dr. John E. Snodgrass, Director, Anchylostomiasis Campaign in Ceylon, for his contribution on Anchylostomiasis.

Mr. G. W. Sturgess, Government Veterinary Surgeon, for notes on Animal Diseases. To Messrs. C. C. Wilson, Diyanilla, Halgranoya; and J. B. Coles, Nilambe, Galaha, contributions on the Care of Livestock.

Mr. H. N. Worth for additions to the General Information.

Messrs. Walker, Sons & Co., Colombo, for notes on Estate Bungalows with Plans, etc., and the Oxy-Acetylene Welding Process.

Mr. P. A. Keiller, Colombo Commercial Co., for the article on the Cultivation and Manuring.

Mr. L. M. W. Wilkins, Culloden, Neboda, for revising the chapter on "Rubber" and for his notes on smoking of Rubber.

The Director of Agriculture, Peradeniya, for his permission to reproduce Bulletins relating to Rubber Diseases.

To Dr. R. L. Spittell, Messrs. M. L. Wilkins and A. S. Long Price for their assistance, and to other gentlemen who so kindly forwarded suggestions and improvements as well as to those who undertook to revise the various chapters and bring the information up-to-date.

Editor's Preface to Fifth Edition.

WERE it not for the valuable assistance received from the many contributors gratefully mentioned below Rutherford's Planters' Note-Book could not have grown to its present encyclopædic comprehensiveness, and our thanks are accorded to those who have supplied information gathered by personal effort and based on carefully recorded experience.

First and foremost our thanks are tendered to Mr. H. K. RUTHERFORD. Although the claims on his time increase rather than diminish Mr. RUTHERFORD has very kindly given considerable assistance and close personal attention to a work which owed its conception to him so far back as 1887.

The Hon. Mr. EDWARD ROSLING contributes an interesting Foreword to the Tea section which still holds its own. The exhaustive chapter owes much of its revision and elaboration to Messrs. R. GARNIER, Millakande Estate, Neboda; M. L. WILKINS, and N. R. CAMERON, Messrs. Harrisons and Crosfield, Colombo.

The Rubber section which is entirely new is the result of the collaboration of Mr. C. O. MACADAM, Culloden Estate, Neboda; Mr. J. F. ELFORD, Ayr Estate, Padukka; and Mr. RUTHERFORD.

Among other new chapters are those assembled under the heading of General Products, viz.:—Cardamoms by Mr. J. WESTLAND, Gammaduwa Estate, Gammaduwa; Cocoa by Mr. LENOX CONYNGHAM, Kandnewera Estate,

RUTHERFORD'S PLANTERS' NOTE BOOK

Matale; and Coconuts by the late Mr. C. M. B. WILKINS, and Messrs. A. S. LONG PRICE, Delwita Estate, Kurunegalla, and L. M. W. WILKINS.

The general information has been thoroughly revised, and many additions supplied by Messrs. F. LEWIS, and W. T. MILLER, the EDITOR, and several firms whose names are mentioned in the text.

The Book-keeping section, which should be found to be extremely useful, and to which the Hon. Mr. E. TURNER has written an appreciative Foreword, has been written by Mr. A. DUNCUM, a member of a well-known Firm of Chartered Accountants, Colombo.

The Manure section has been re-written and brought thoroughly up to date.

The Medical chapter has received considerable addition and careful checking by a Medico well acquainted with the conditions which obtain on estates.

The Legal section has been amplified and revised, and the P. L. F. rules have been added.

Other assistants to whom we accord appreciative thanks are:—Messrs. H. F. NAUGHTON and C. H. JOLLIFFE.

A weakness of former editions undoubtedly was the indexing, and the present volume contains an index which will make it unnecessary to spend more than a few seconds in locating any item which this volume contains.

Editor's Preface to Sixth Edition.

THE immediate success of the fifth edition which was sold out within a week of publication, demonstrated the popularity of this work and the necessity for a further supply being printed. After consideration, and on realising that many months would elapse before a reprint could be issued, it was decided not merely to reprint the fifth edition but to issue a sixth, revised to the date of publication.

As inevitably happens in a work of this nature it was found desirable to add various items of information, with the result that the Rubber Chapter has been considerably amplified and Coconuts as well as Cocoa are now dealt with each in a chapter to itself. Tobacco, Sugar Cane, Jute, Manila Hemp, Sisal Hemp, Ramie, are all accorded a space in the sixth edition, and it is hoped that the information under the latter heads, although not of general interest, will be found useful to one section of the subscribers to this volume. The new method of presenting the legal section will doubtless facilitate reference to the information contained under this heading.

In addition to the many names of contributors which appear in the preface to the fifth edition, we acknowledge with gratitude the assistance of Mr. W. H. Biddulph, J.P., Mr. L. C. Brown, Inspector of Coconut Trees,

F.M.S., Mr. H. F. MacMillan, F.L.S., F.R.H.S., Curator, Royal Botanic Gardens, Ceylon, Mr. M. L. Wilkins, who obtained the prize for the Planters' Association Essays in 1904 for Tea Pruning and in 1912 for Cooly Line Construction, and Mr. H. K. Rutherford for forwarding for inclusion The Rubber Growers' Association Recommendations, compiled by Mr. Sydney Morgan.

Foreword to Fifth Edition.

MUCH water has flowed through the Mahavillaganga since the original precursor of this Book saw the light in 1887, and even since the last Edition was published in 1903, great and important changes have taken place in tropical agriculture in Ceylon.

It is felt the developments in Rubber and Coconut plantation and the immense financial interests concerned warrant an extension of this Book so as to embrace matter relative to these two products, which would be "available for easy reference, concisely compiled and unencumbered with irrelevant matter."

The excellent methods in vogue by Ceylon planters in apportioning every item of expenditure in their Estate accounts to its proper class of work has been adopted by planters generally throughout the East, and this careful analysis of costs enables proprietors to at once see where savings in costs of production can be effected.

This Book will be found eminently useful to all who have the care of Estates, as by its aid they will be able to gain information collated from many reliable sources on all subjects affecting the economic working of their properties.

I need say little as regards the value of the information to Tea growers, as that has been already proved. Although the older planters have accumulated experience of their own to guide them, they are nevertheless sometimes at a loss to lay their hands on the data they are in need of, and to the young Tea planter such a work as this is simply a necessity.

To Rubber and Coconut planters they have here for the first time a mass of condensed experience which should be of great service to them, as it will save them the trouble of reading through the piles of published but fugitive literature on these subjects, in order to get at the required information. Doubtless the Rubber knowledge of to-day will in some of its aspects be obsolete in the near future, so rapid is the march of progress, but whether slow or fast the contents of this Book bring the planter up-to-date, and with this I feel sure he will be content.

A handwritten signature in dark ink, appearing to read "W. M. Thackeray". The script is cursive and fluid, with the first letters of the first and last names being capitalized and prominent.

Remarks on Index.

THE alphabetical index at the end of the book should always be consulted, as different aspects of the subject to which reference is being made may be found in another chapter.

| | | | | | |
|---------|---------|-------------------------|-----|-----|------|
| First | Edition | ... | ... | ... | 1887 |
| Second | do | ... | ... | ... | 1889 |
| Third | do | ... | ... | ... | 1892 |
| Fourth | do | ... | ... | ... | 1903 |
| Fifth | do | (considerably enlarged) | | | 1913 |
| Sixth | do | .. | .. | | 1914 |
| Seventh | do | .. | .. | ... | 1918 |

GENERAL INFORMATION.

MACHINERY NOTES.

LAWS OF MOTION (Newton.)

1. Every body perseveres in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by forces to change that state.
2. Change of momentum is proportioned to force and takes place in the direction of the force.
3. To every action there is an equal and contrary re-action; or the mutual action between two bodies are always equal and oppositely directed.

THE FOLLOWING ARE PRINCIPLES IN MECHANICS—

Stable Equilibrium results, (1) when the centre of gravity is below the fulcrum, (2) beneath and between two fulcras, (3) above and within three or more.

A Steelyard is a balance, in which one weight is made to do for several, by varying the distance from the fulcrum. This is done in the common sort, by moving the weight, in the Danish by moving the fulcrum.

Speed varies inversely as power. Friction is independent of velocity.

Single pulley halves the speed and doubles the power (weight and friction of pulley not considered.)

Several pulleys, each with one cord fixed, multiply the power by two for each such pulley.

Two multiplying block pulleys multiply the power by the number of cords supporting the lower block.

Several pulleys, when one cord of each goes direct to the work, multiply by two for each pulley and deduct one.

Projectile: farthest range of a projectile on the level, at any pace, is at an elevation of 55° . Uphill or downhill, subtract or add half the angle of elevation or depression.

Centrifugal force is the square of the velocity, divided by the radius.

Result of two forces at point. Draw lines in directions of the forces, and in proportion to the forces. Complete the parallelogram: the diagonal will represent the resultant force.

The centre of gravity of two objects, is at a distance from either inversely proportionate to their weights.

Centre of gravity of a triangular body, is found by bisecting two sides, and joining to opposite angles or bisecting one side joining to opposite angle, and marking off one-third from the bisection.

Centre of gravity of a hollow triangle, is on the bisection of the angles formed by joining the centres of the sides.

MOTION AND FORCE.

Velocity = time \times acceleration + original velocity.

Space traversed = time \times velocity.

Space travelled when increasing speed, add half acceleration \times square of time.

Mass is volume \times density (and converse).

Momentum, or power to continue motion, is mass \times velocity.

Moving force, or power to add motion, is mass \times acceleration.

UNIT OF FORCE.

The British Unit of Force is that which gives, in one second, a speed of one foot per second to a mass of one pound.

FORCE REQUIRED TO MOVE A BODY.

| | |
|---------------------------------------|------------------------------|
| A stone along a rough chiselled floor | ... Two-thirds of its weight |
| " " " " on rollers | .. Thirty-second " " |
| " " " " wooden floor | ... Three-fifths " " |
| " " " " on rollers | ... One-fortieth " " |

CALCULATING THE SPEED OF ENGINES.

Formulae for calculating the load and speed which a steam engine of a given size and steam pressure may be expected to give:—The load or "constant torque" at 1 foot radius on the crank-shaft is usually obtained by multiplying the horse-power by 33,000 to get the foot-pounds per minute and then dividing by the speed in feet per minute at 1 foot radius. But by cancellation the following formula may be obtained: T = torque at 1 foot radius, P = mean effective pressure in the cylinder in pounds per square inch, D = diameter of the cylinder in inches, and L = the length of the stroke in feet. Then $T = \frac{P D^2 L}{4}$. To illustrate; what is the torque at 1 foot radius of an 8 \times 10 in. engine with 100 pounds mean effective pressure? $T = \frac{100 \times 64 \times 10}{4 \times 12} = 1,333$ lbs.

The formula was derived by using the *PLAN* formula to find the foot-pounds per minute and dividing by the speed in feet per minute at 1 foot radius. $\frac{P L D_s \cdot 7854 \times 2 \times \text{revs. per min.}}{\text{rev. per min.} \times 6.28} = T = \frac{P D L}{4}$

Practically, the engine would not give the calculated load owing to friction of the bearings, and the formula should therefore read :

$$\frac{P D^2 L}{4} \times \text{efficiency of engine.}$$

The following formula for the speed of steam engines is based on the principle that the area of the steam port, the volume of the cylinder and the velocity of the steam determine the revolutions per minute of the crank-shaft : Let N = number of revolutions per minute. A = the area of the steam port in square feet, V = volume of cylinder in cubic feet.

$$\text{Then } N = \frac{A \times \text{velocity of steam.}}{2 V}$$

The velocity of steam may be 6,000 feet per minute for plain slide-valve engines, 7,500 for Corliss and high-speed engines and from 6,000 to 12,000 feet per minute for marine type engines. For example : what are the revolutions per minute of the above 8 x 10 in. engine with a plain slide valve ? The port opening is 8 x $\frac{1}{4}$ in. The area of port in square feet = $\frac{8 \times \frac{1}{4} \times \frac{1}{4}}{144} = .0278$. The volume of the cylinder in cubic feet = $8^2 \times \frac{7854 \times 10}{1728} = 2908$. Then $N = \frac{.0278 \times 6,000}{2 \times 2908} = 286$ revolutions per minute.

The above formulae are specially useful for calculating the capacity of hoisting machines driven by steam engines ; either to find the torque at the centre of rope on the drum, or the speed, or the load at the pitch circles of the gears, for calculating the strength of gear teeth, &c. For example, what is the load at the centre of the rope on a drum which a pair of the above hoisting engines can give, with a 5 to 1 ratio of spur gears ? Diameter of pitch circle of drum, 14 in. ; efficiency of engines, 80 per cent. ; efficiency of gears, 90 per cent. The torque at 1 foot radius on the crank-shaft = $1,333 \times 2 \times .80 = 2,133$ lbs., nearly. Then the load at the rope = $2,133 \times 5 \times .90 \times \frac{1}{2} = 16,454$ lbs. Suppose the diameter of the pitch circle of the pinion on the crank-shaft is 8 inches, then load at the teeth = $\frac{2,133 \times 12}{4} = 6,399$ lbs.

PULLEYS.

Let R = Revolutions per minute of main (or driving) shaft.

r = „ „ „ pulleys (or driven shaft) on the machine.

D = Diameter of pulley on main (or driving) shaft.

d = „ „ „ (on driven shaft) on machine.

Then

$$D = \frac{d \times r}{R} \quad d = \frac{D \times R}{r} \quad r = \frac{D \times R}{d} \quad R = \frac{d \times r}{D}$$

To find the Diameter of a Pulley required on main shaft, to drive any machine at a given speed (the speed of the main shaft and the diameter of the pulley on the machine being known).

Multiply the diameter of the pulley on the machine by the given speed of the machine and divide the product by the speed of the main shaft.

Example:—

Diameter of pulley on machine = 24 inches.

Speed of machine = 100 revolutions per minute

Speed of main shaft = 120 revolutions per minute.

Then diameter of pulley required on main shaft = $\frac{24 \times 100}{120} = 20$ inches.

To find the Diameter of a Pulley required on a machine, so that it may be driven at a given speed (the diameter of the pulley on the main shaft and the speed of the main shaft being known).

Multiply the diameter of the pulley on the main shaft by the speed of the main shaft and divide the product by the given speed of the machine.

Example:—

Diameter of pulley on main shaft = 20 inches.

Speed of main shaft = 120 revolutions per minute.

Speed of machine = 100 revolutions per minute.

Then diameter of pulley required on machine = $\frac{20 \times 120}{100} = 24$ inches.

To find the speed at which any machine will be driven, by a main shaft at a given speed (the diameter of the pulleys on main shaft and machine being known).

Multiply the diameter of pulley on main shaft by the given speed of main shaft and divide the product by the diameter of the pulley on the machine.

Example :—

Diameter of pulley on main shaft = 20 inches.

Speed of main shaft = 120 revolutions per minute.

Diameter of pulley on machine = 24 inches.

Then speed at which machine will be driven = $\frac{20 \times 120}{24} = 100$ revolutions per minute.

To find the speed at which the main shaft would have to be driven, to drive any machine at a given speed, (the diameters of the pulleys on the main shaft and machine being known).

Multiply the diameter of the pulley on machine by its given speed and divide the product by the diameter of the pulley on the main shaft.

Example :—

Diameter of pulley on machine = 24 inches.

Speed of machine = 100 revolutions per minute.

Diameter of pulley on main shaft = 20 inches.

Then speed at which main shaft would have to be driven = $\frac{24 \times 100}{20}$
= 120 revolutions per minute.

MEASUREMENTS FOR OPENING UP NEW LAND.

SUPERFICIAL versus BASE MEASUREMENT.

It is remarkable what a number of persons will be found to declare that no matter how steep the land may be, there are the same number of trees to the acre. This would be correct if the distances between each tree were horizontally equal. This in practice is never the case as regards the distance between the plants in each row, though the *rows* themselves are of equal distances.

Let us take a simple illustration. Place a playing card flat on a sheet of paper. Run a pencil round its outline on the paper, and you have its superficial area. Now draw a dozen lines transversely across the playing card and prick off, say, 10 divisions on each line. You will then have 120 such points on that card. Take another card from the same pack and mark it in the same way. Your two cards will then have 240 points on them.

Now take the first card and place one of its longest edges on the outline you drew on the paper, and put the other card, also on its long side, on the opposite outline and let the two cards lean against each other, like a letter A, and you will then find that you have 240 points arranged over the surface equal to only *one* of the two cards; or, to put it in other language, you have 240 trees on your surface of steep land as against 120 if it were perfectly flat.

A careful consideration of the 47th Prop. in Euclid's 1st book will make this perfectly clear.

DISTANCES IN CHAINING.

In surveying a piece of land, or say in laying out a block of land, one of the most important considerations is the difference of length along *flat* as against *steep* land, or what is called the difference between the hypotenuse and the base. This differs for each angle of the quadrant the steeper the angle the longer the hypotenuse. Those who have no instruments for measuring such angles of inclination and so discovering the ratio above indicated, will find it convenient to adopt the following method for getting at the base measurement.

Let the required line be laid down on the ground and at convenient intervals stake off a number of points. Then place a staff on the lower of any two of these and hold it exactly vertical over that point, while the distance measured horizontally with a rod is taken from the staff to the next point laid on the ground.

The sum of these horizontal distances will equal the correct base, provided that the staff is always held *exactly perpendicular*, and the spacing rod is exactly horizontal. The thickness of the staff is also a consideration, and must be compensated for.

It is important to have this method in mind when lining a new clearing, as on the careful spacing, horizontally, between the rows will depend the regularity of the rows.

A very simple form of clinometer can be made with a pole, to one end of which is fitted a sharp pointed iron shoe. Fix to the other end a semi-circular disc of wood, divided into 180 equal parts. The rounded edge of the disc should be directed downwards, and the whole made to revolve stiffly but smoothly round a pin driven through the centre of the disc, and fixed to the pole.

At each end of the flat side of disc, corresponding to the horizontal line that passes through its centre, insert two stout pins at right angles to the surface of the disc, and from the central pin suspend a plummet.

All that has to be done, therefore, is to fix the pole into the ground by its shoe. Get it perpendicular as indicated by the plummet, and sight along the two pins on the disc to a rod held by an assistant; this second rod being of the same height as the centre of the disc held by the observer. The angle will be indicated by the plummet line on the disc.

With the table giving the corresponding angle will be found the corresponding percentage to be deducted from the measurement taken along the inclined plane or hypotenuse of that angle, so that all you will have to do is to take off that percentage and proceed to the next point, repeating the process only where the land is steep, or so inclined as to afford a difference of appreciable value.

GENERAL INFORMATION

7

Table for reducing Hypotenuse to base, i.e. the difference between measurements taken along a slope and its horizontal equivalent.

| Angle in degrees. | Equivalent slope. | Correction % | Angle in degrees. | Equivalent slope. | Correction % |
|-------------------|-------------------|--------------|---|-------------------|--------------|
| 3 | 1 in. 19-08 | 0-14 | 20 | 1 in. 2-74 | 6-03 |
| 4 | 1 in. 14-30 | 0-24 | 25 | 1 in. 2-14 | 9-37 |
| 5 | 1 in. 11-43 | 0-38 | 30 | 1 in. 1-73 | 13-39 |
| 6 | 1 in. 9-51 | 0-54 | <p><i>Note.</i>—The rate of slope (ratio of hypot. to perpendicular)=cosec. of angle of inclination.</p> <p>The rate of inclination (ratio of base to perpendicular)=cotan. of the angle of inclination.</p> <p><i>Example.</i>—What is the base measurement of a slope of 100 feet, when the angle of inclination is 20 degrees?</p> <p style="text-align: right;">100-00 ft. Less 6-03 ft. Answer 93-97 ft.</p> | | |
| 7 | 1 in. 8-14 | 0-74 | | | |
| 8 | 1 in. 7-11 | 0-97 | | | |
| 9 | 1 in. 6-31 | 1-23 | | | |
| 10 | 1 in. 5-67 | 1-52 | | | |
| 11 | 1 in. 5-14 | 1-83 | | | |
| 12 | 1 in. 4-70 | 2-18 | | | |
| 13 | 1 in. 4-33 | 2-56 | | | |
| 14 | 1 in. 4-01 | 2-97 | | | |
| 15 | 1 in. 3-73 | 3-40 | | | |
| 16 | 1 in. 3-45 | 3-87 | | | |
| 17 | 1 in. 3-27 | 4-37 | | | |
| 18 | 1 in. 3-07 | 4-89 | | | |
| 19 | 1 in. 2-90 | 5-44 | | | |

NUMBER OF CUBIC FEET OF VARIOUS SOILS IN A TON.

| | | | |
|-------------|-------------|-------------------|---------------|
| Loose Earth | = 24 c. ft. | Earth with Gravel | = 17-8 c. ft. |
| Coarse Sand | = 18-6 „ | Clay „ „ | = 14-4 „ |
| Clay | = 18-6 „ | Common Soil | = 15-6 „ |

SOLID MEASURE.

| | |
|-------------------|-----------------------------|
| Cubic inches 1728 | = 1 cubic foot. |
| 46656 | = 27 „ equals 1 cubic yard. |

CIRCLE.

| | |
|---------------------------|----------------------------|
| Diameter × 3-1416 | = circumference. |
| Diameter × -8862 | = side of an equal square. |
| Diameter, squared × -7854 | = area of circle. |
| Radius × 6-28318 | = circumference. |
| Circumference ÷ 3-1416 | = Diameter. |

METRIC SYSTEM.

LENGTH.

| | Inches. | Yards. |
|------------|--------------------|--------------------|
| Millimetre | ... 0-39 | ... 0-001 |
| Centimetre | ... 0-394 (nearly) | ... 0-11 |
| Decimetre | ... 3-937 | ... 1-09 |
| Metre | ... 39-37 | ... 1-094 (nearly) |
| Kilometre | ... 39370-79 | ... 1093-633 |

| SQUARE. | | |
|-----------------------------|---------------|-------|
| | Square Yards. | Acre. |
| Centiare (square metre) ... | 1 196 | — |
| Are (100 square metres) ... | 119 603 | ·025 |
| Hectare ... | 11960 333 | 2 471 |

TO CONVERT METRIC TO ENGLISH MEASURES AND WEIGHTS.

To convert grammes to ozs. avoird. multiply by 20 and divide by 567.
 To convert kilogrammes to lbs., multiply by 1000 and divide by 454.
 To convert litres to gallons, multiply by 22 and divide by 100.
 To convert litres to pints, multiply by 88 and divide by 50.
 To convert millimetres to inches, multiply by 10 and divide by 254.
 To convert metres to yards, multiply by 70 and divide by 64.

RULE FOR MEASURING THE CAPACITY OF A SQUARE CISTERN.

Multiply the length in feet by the width in feet, and multiply that by 1,728, then divide by 231. The quotient will be the number of gallons capacity on one foot in depth.

RULES FOR MEASURING THE CAPACITY OF A CIRCULAR CISTERN.

Multiply the square of the diameter by 7854, or the square of the circumference by 07958, in order to find the area of a section of the cistern, then multiply the area by the depth in inches, and divide the product by 231. The quotient will equal the number of gallons the cistern will contain.

In measuring cisterns, etc., $3\frac{1}{2}$ gallons are estimated to 1 barrel; 63 gallons to 1 hogshead.

RULES FOR MEASURING TANK CAPACITIES.

To find the number of gallons a tank or other vessel will hold, divide the number of cubic inches it contains by 231. If rectangular, multiply together the length, breadth and depth. If cylindrical, multiply the square of the diameter by 7854, and the product by the depth. If conical, add together squares of diameters of top and bottom, and the product of the two diameters. Multiply their sum by 7854, and the resulting product by the depth. Divide the product by 3.

HANDY WEIGHTS AND MEASURES.

A Tumbler contains 10 ounces or half a pint; a Teacup 3 ounces or 1 gill; a Wineglass 2 ounces; a Table-spoon 4 drachms; a Dessert-spoon 2 drachms; a Tea spoon 1 drachm—all approximately only.

GENERAL INFORMATION

9

WEIGHTS OF SUBSTANCES.

| | | |
|------------------------|---|----------------------------|
| Aluminium | = | ·0926 lbs. per cubic inch. |
| Brass (copper and tin) | = | ·3194 " " |
| " (copper and zinc) | = | ·2828 " " |
| Bronze | = | ·3147 " " |
| Gold | = | ·6965 " " |
| Copper, cast | = | ·3179 " " |
| Iron, cast | = | ·2807 " " |
| " wrought | = | ·2817 " " |
| Lead, rolled | = | ·4119 " " |
| Steel | = | ·2823 " " |
| Silver, pure | = | ·3788 " " |
| Platinum | = | ·7356 " " |
| Tin | = | ·2673 " " |
| Zinc (rolled) | = | ·2600 " " |

WEIGHTS OF MATERIALS.

| | | | |
|--------------------|--------|----------------------|------------|
| Air | ... .. | per cubic foot .lbs. | ·08072 |
| Asphalte | ... .. | " " | 168 |
| Basalt | ... .. | " " | 172 to 184 |
| Bricks | ... .. | " " | 100 to 125 |
| Cabook | ... .. | " " | 108 |
| Cement | ... .. | " " | 90 to 100 |
| Chalk | ... .. | " " | 145 to 162 |
| Clay | ... .. | " " | 119 |
| Concrete, ordinary | ... .. | " " | 119 |
| Do cement | ... .. | " " | 137 |
| Copper | ... .. | " " | 549 |
| Earth | ... .. | " " | 77 to 125 |
| Ebony | ... .. | " " | 74 |
| Glass, bottle | ... .. | " " | 170 |
| Granite | ... .. | " " | 131 to 135 |
| Ironwood | ... .. | " " | 71 |
| Iron | ... .. | " " | 480 |
| Jakwood | ... .. | " " | 42 |
| Jarrah | ... .. | " " | 64 to 71 |
| Lead | ... .. | " " | 709 |
| Marble | ... .. | " " | 169 |
| Mica | ... .. | " " | 175 |
| Mortar (average) | ... .. | " " | 106 |

WEIGHTS OF MATERIALS.—(Contd.)

| | | | | | |
|--------------|-----|-----|-----|---------------------|------------|
| Oil | ... | ... | ... | per cubic foot lbs. | 58 |
| Pine, white | ... | ... | ... | " " | 27 to 34 |
| Plumbago | ... | ... | ... | " " | 140 |
| Sand, quartz | ... | ... | ... | " " | 171 |
| Do river | ... | ... | ... | " " | 117 |
| Satinwood | ... | ... | ... | " " | 60 |
| Silver | ... | ... | ... | " " | 654 |
| Slate | ... | ... | ... | " " | 167 to 181 |
| Steam | ... | ... | ... | " " | 055 |
| Teak | ... | ... | ... | " " | 46 to 54 |
| Tin (cast) | ... | ... | ... | " " | 455 |
| Water | ... | ... | ... | " " | 92 |

DEGREES OF HEAT.

The following are the formulæ for the conversion of degrees of one scale to those of another:—

$$\begin{array}{l} \frac{\text{Centigrade}^{\circ} \times 9}{5} + 32 = \text{Fahr.}^{\circ} \\ \frac{\text{Réaumur}^{\circ} \times 9}{4} + 32 = \text{Fahr.}^{\circ} \\ \frac{\text{Fahr.}^{\circ} - 32 \times 4}{9} = \text{Cent.}^{\circ} \end{array} \quad \begin{array}{l} \frac{\text{Fahr.}^{\circ} - 32 \times 4}{9} = \text{Réaumur}^{\circ} \\ \frac{\text{Centigrade}^{\circ} \times 4}{5} = \text{Réaumur}^{\circ} \\ \frac{\text{Réaumur}^{\circ} \times 5}{4} = \text{Centigrade}^{\circ} \end{array}$$

| | | | | |
|-----------------|-----|-----|---|----------------------------------|
| Zero Fahrenheit | ... | ... | = | Congeeing point of Sal Ammoniac. |
| Do Réaumur | ... | ... | = | Melting point of Ice. |
| Do Centigrade | ... | ... | = | do |
| 32° Fahrenheit | ... | ... | = | Freezing point of Water. |
| 80° Réaumur | ... | ... | = | Boiling do |
| 100° Centigrade | ... | ... | = | do do |
| 212° Fahrenheit | ... | ... | = | do do |

BOILING POINT.

| | | | Centigrade. | Fahrenheit. |
|------------------|-----|-----|-------------|-------------|
| | | | ° | ° |
| Alcohol boils at | ... | ... | 74.4 | 173.1 |
| Ether | " | ... | 35.5 | 96 |
| Quicksilver | " | ... | 380 | 680 |
| Water | " | ... | 100 | 212 |

AN ACRE OF LAND.

| Depth. | Frontage. | Depth. | Frontage. | Depth. | Frontage. | Depth. | Frontage. |
|--------|-----------|--------|-----------|--------|-----------|--------|-----------|
| Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. |
| 20 | 2,178 | 120 | 363 | 210 | 207 | 320 | 136 |
| 30 | 1,459 | 130 | 336 | 220 | 198 | 340 | 128 |
| 40 | 1,085 | 140 | 312 | 230 | 189 | 360 | 121 |
| 50 | 875 | 150 | 290 | 240 | 181 | 380 | 114 |
| 60 | 725 | 160 | 272 | 250 | 174 | 400 | 109 |
| 70 | 622 | 170 | 250 | 260 | 167 | 450 | 96 |
| 80 | 545 | 180 | 242 | 270 | 161 | 500 | 87 |
| 90 | 484 | 190 | 224 | 280 | 155 | 550 | 79 |
| 100 | 436 | 200 | 218 | 290 | 150 | 600 | 73 |
| 110 | 396 | | | 300 | 145 | | |

CUBIC INCHES TO THE CWT.

| | | | | | | | |
|-------------------------|-----|-----|--------|---|---------|---|--------------|
| Cast Iron | ... | ... | Weight | × | ·00235 | = | Cubic inches |
| Wrought Iron | ... | ... | " | × | ·002464 | = | " " |
| Brass (copper and zinc) | ... | ... | " | × | ·002553 | = | " " |
| Lead | ... | ... | " | × | ·00367 | = | " " |

LAND MEASURE.

DRY MEASURE.

| | Amunam. | Pela. | Bushels. | Parrahs. | Timbas. | Pecks. | Kurunis or Labas. | Seers or Quarts. | Equiv. in Acres. |
|------------------|---------|-------|----------|----------|---------|--------|-------------------|------------------|------------------|
| 1 Amunam | ... | 1 | 4 | 5 | 8 | 10 | 20 | 40 | 160 |
| 1 Pela | ... | — | 1 | 1½ | 2 | 2½ | 5 | 10 | 40 |
| 1 Bushel | ... | — | — | 1 | 1½ | 2 | 4 | 8 | 32 |
| 1 Parrah or Bera | ... | — | — | — | 1 | 1½ | 2½ | 5 | 20 |
| 1 Timba | ... | — | — | — | — | 1 | 2 | 4 | 16 |
| 1 Peck | ... | — | — | — | — | — | 1 | 2 | 8 |
| 1 Kuruni or Laha | ... | — | — | — | — | — | — | 1 | 4 |
| 1 Seer or Quart | ... | — | — | — | — | — | — | — | 1 |

WET MEASURE. (Southern Province.)

| | | |
|-------------------------|-----------|----------------------|
| 2 Bushels and 2 Pecks = | 1 Acre = | 1 Pela and 8 Kurunis |
| 2 Pecks and 4 Quarts = | 1 Rood = | 5 Kurunis |
| $\frac{1}{2}$ Quart = | 1 Perch = | $\frac{1}{2}$ Kuruni |

The exact equivalent of the Amunam (wet measure) is difficult to determine, but approximates 2·3634 acres.

In Dutch times in Ceylon the Morgen was a standard of land measure, and the following proportions were recognised:—

| | A. | R. | P. | |
|-----------------------|----|-----|-------|-----------------|
| 1 Rhenish Morgen = | 2 | 0 | 16·52 | English Measure |
| 600 Quadraat Roeden = | | 1 | | Morgen |
| 1 do = | | 144 | | Quadraat Voeten |
| 1 Quadraat Voeten = | | 144 | | Quadraat Duim |

(*Surveyor-General's Manual.*)

MUD LANDS.

| | |
|--------------------|-------------------------|
| 1 Amunam = | 2 $\frac{1}{2}$ Acres |
| 1 Pela = | 2 Roods 20 Perches |
| 1 Kuruni or Laha = | 10 Perches |
| 1 Parrah = | 1 Rood 10 Perches |
| 1 Bushel = | $\frac{1}{2}$ Acre |
| 1 Peck = | 20 Perches |
| 1 Quart or Seer = | 2 $\frac{1}{2}$ Perches |

KANDYAN DISTRICT.

| | |
|-----------|------------------------|
| 8 Lahas = | 1 Kuruni. |
| 80 „ = | 10 „ = 1 Pela. |
| 320 „ = | 40 „ = 4 „ = 1 Amunam. |

KEGALLE DISTRICT.

| | |
|--------------------|-------------------------|
| 1 Seruwa = | 2 $\frac{1}{2}$ Perches |
| 1 Peck = | 20 Perches |
| 1 Bushel = | $\frac{1}{2}$ Acre |
| 1 Parrah = | 1 Rood and 10 Perches |
| 1 Laha or Kuruni = | 10 Perches |
| 1 Pela = | 2 Roods and 20 Perches |
| 1 Amunam = | 2 $\frac{1}{2}$ Acres |
| 10 Kurunis = | 1 Pela |
| 4 Pelas = | 1 Amunam |

SOWING QUANTITIES.

| | |
|------------------------------------|------------------------------------|
| 1 Bushel's sowing extent = 2 roods | 1 Amunam's sowing extent = 3 acres |
| = 80 pehs. | 1 Pela's " " = 3 roods |
| 1 Peck's " " = 20 pehs. | 1 Laba's or Kuruni's " = 12 pehs |
| 1 Quart's or Seer's " = 2½ pehs. | 1 Parrah's " = 1 rd. 20 perches. |

The quart, seer, laha, kurnni and bushel are estimated as bearing the same relation to one another as in dry measure.

LONG MEASURE.

Inches.

| | | | | | | | | | |
|-------|---|---------|---|---------|---|-----------|---|----------|---------------|
| 12 | = | 1 foot. | | | | | | | |
| 36 | = | 3 | = | 1 yard. | | | | | |
| 72 | = | 6 | = | 2 | = | 1 fathom. | | | |
| 198 | = | 16.5 | = | 5.5 | = | 2.75 | = | 1 perch. | |
| 7920 | = | 660 | = | 220 | = | 110 | = | 40 | = 1 furlong. |
| 63360 | = | 5280 | = | 1760 | = | 880 | = | 320 | = 8 = 1 mile. |

Inches.

| | | | | | | | | | |
|-------|---|---------|---|----------|---|---------|--|--|--|
| 7.92 | = | 1 link. | | | | | | | |
| 792 | = | 100 | = | 1 chain. | | | | | |
| 63360 | = | 8000 | = | 80 | = | 1 mile. | | | |

SQUARE MEASURE.

Sq. inches.

| | | | | | | | | | |
|---------|---|-------------|---|-------------|-------|---|--------------|---------------|---------------|
| 144 | = | 1 sq. foot. | | | | | | | |
| 1296 | = | 9 sq. feet. | = | 1 sq. yard. | | | | | |
| 39204 | = | 272.25 | " | = | 30.25 | = | 1 sq. perch. | | |
| 1568160 | = | 10890 | " | = | 1210 | = | 40 | = 1 sq. rood. | |
| 6272640 | = | 43560 | " | = | 4840 | = | 160 | = 4 | = 1 sq. acre. |

Links.

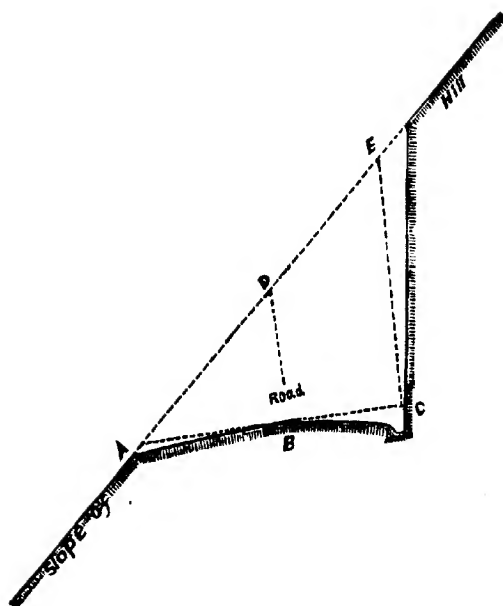
| | | | | | | | | | |
|--------|---|------------|---------|-----|---|---------|--|--|--|
| 625 | = | 1 perch. | | | | | | | |
| 10000 | = | 1 chain | | | | | | | |
| 25000 | = | 2.5 equals | 1 rood. | | | | | | |
| 100000 | = | 10 | " | 411 | = | 1 acre. | | | |

TO MEASURE METAL.

All metal or gravel should be piled in the form adopted by the P. W. D., and the contents calculated as follows :

| | | | |
|---|------------------|----------------|------------------|
| Length of base | ... 18 ft 6 ins. | Height of pile | ... 2 ft. 6 ins. |
| Breadth of base | ... 5 " | Length of top | ... 13 " 6 " |
| $= \frac{18\frac{1}{2} + 13\frac{1}{2}}{2} \times \frac{5}{2} \times \frac{5}{2} = \frac{32}{2} \times \frac{25}{2} \times \frac{5}{2}$ | | | |
| $= 16 \times \frac{25}{2} = 100 \text{ ft. (cubic.)}$ | | | |

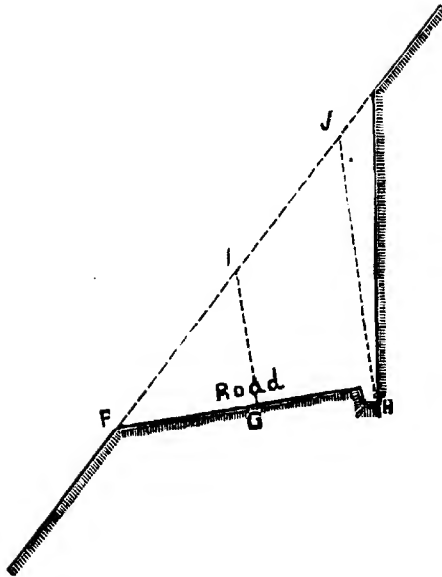
HOW TO MEASURE EARTH-WORK.



A equals 0 ft.
 BD „ 5 „
 CE „ 10 „

Equals 15 ft. divide by 3 equals 5 ft. :—Average height of cutting
 in section 1.

HOW TO MEASURE EARTH-WORK.—(Contd.)



F equals 0 ft.

GI „ 10 „

HJ „ 20 „

Equals 30 ft. divided by 3 equals 10 average, and so on for each section : add the averages together (= in this case 15) divide by the number of sections ($15 \div 2 = 7\frac{1}{2}$) and then multiply result as under.

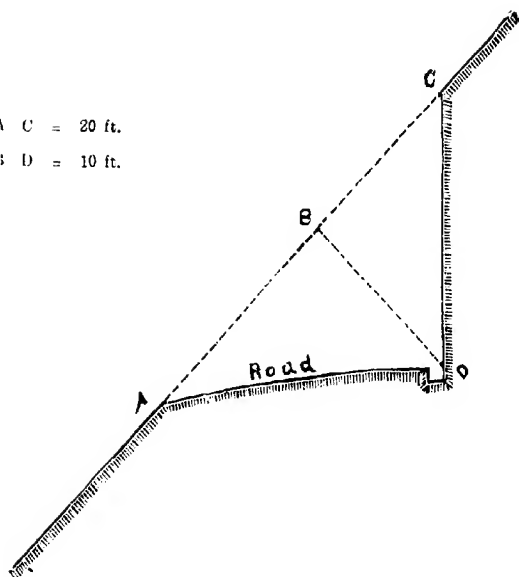
AVERAGE of sections \times width of road \times length of section equals total cubic feet.

HOW TO MEASURE EARTH-WORK.—(Contd.)

Another Way. By Triangles.

$$A C = 20 \text{ ft.}$$

$$B D = 10 \text{ ft.}$$



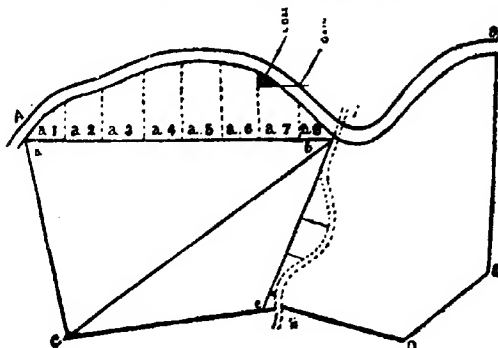
Multiply base (A C) $\times \frac{1}{2}$ the perpendicular height ($\frac{1}{2}$ B D) = area of section, i.e. $20 \times \frac{1}{2} = 100$ ft.

Add all the sections together, divide by the number of them to get the average and multiply by the total length in feet. Result total cubic feet of earth-work.

HOW TO MEASURE EARTH-WORK.—(Contd.)**Contractor's Method.**

Take half the height of D. C., multiply by width of road D A obtain average of each pair of sections and multiply by the distance between them. Result number cubic feet.

NOTE.—Sections are generally 100 or 50 feet in length.



TO FIND THE AREA ON A PLAN OF ANY PIECE OF LAND THAT IT IS PROPOSED TO BLOCK OFF SEPARATELY, SAY FOR SUBDIVISION OF WEEDING CONTRACTS.

Suppose the block on the plan to be that contained within the points A B C D and E and it is intended to use the path i, ii as a subdivision and it is required to know the area of A C i, ii on the left of the path. Draw the lines a b and b c.

On the same scale as that of the plan is constructed, lay off the equidistant perpendiculars a1, a2, a3, &c., on both lines so that they touch the broken edge formed by the bent line A B, and i, ii. It will be seen, especially in the case of offset a7 the line nearest a8 is much shorter than the side next to a5, so that if a line is drawn parallel to the base a b, from the top of the line on the right of portion a7, to a6, it will exclude the shaded area, but will include an equal area not shaded. It follows therefore that if gains equals losses, as they do in this case, that we need only take the distance from the point of intersection of the broken line with the equalising line, and measure from that point by the shortest direction, to the base line a b. In like manner let all the other offsets be treated.

Care should be taken that the offsets should be put at say one chain apart on the same scale as the plan, and the sums of their mean lengths as described above be taken and multiplied by the width of the interval. The remainder of the figure A b, c C, can be reduced to two triangles by connecting C with b, the area of which, added to the sums of the offset pieces, equal the total area required.

| | | |
|------------------------|---|----------------------|
| Thus area of C a b ... | = | 1,742,130 sq. Links. |
| „ of C b c .. | = | 994,200 „ |
| „ of Offset A b ... | = | 824,640 „ |
| „ of „ b c i i ... | = | 98,660 „ |
| Total in sq. Links ... | = | 3,659,630 sq. Links. |

TO REDUCE SQUARE LINKS TO ACRES.

Take the preceding case, 3,659,630.

Point off five places of decimals from the right, and it will leave 36 cut off. Multiply the remainder by 4, and point off as before, and it will leave 2 to the left. Again multiply the last remainder (38,520) by 40, and the remainder will be 15 to the left, after pointing off decimals as at first. The area of the figure therefore is 36 acres, 2 roods and 15 perches.

HINTS FOR DRAUGHTSMEN AND PATTERN MAKERS.

The surface of a sphere equals the square of the circumference multiplied by 0·3183. The diameter of a sphere equals the square root of its surface multiplied by ·56419. The side of an inscribed cube equals the radius multiplied by 1·1547. The diameter of a circle equals the square root of the area multiplied by 1·12838. The diameter of a sphere equals the cubic root of its solidity multiplied by 1·2407. The circumference of a circle equals the diameter multiplied by 3·1416, which is the ratio of the circumference to the diameter. The area of a triangle equals the base multiplied by one-half of its height. The diameter of a circle equals the circumference multiplied by 0·31831. The side of an inscribed equilateral triangle equals the diameter of the circle multiplied by ·86. The surface equals the product of the diameter and the circumference. The radius of a circle equals the circumference multiplied by ·159156. The circumference of a circle multiplied by ·282 equals one side of a square of the same area. The area of a circle equals the square of the radius multiplied by 3·1416. The square root of the surface of a sphere multiplied by 1·772454 equals the circumference. The area of a circle equals one quarter of the diameter multiplied by the circumference. The area of an ellipse equals the product of both diameters and ·7854. The radius of a circle equals the square root of the

area multiplied by .56419. The circumference of a sphere equals the cube root of its solidity multiplied by 3.8978. The side of a square equals the diameter of a circle of the same area multiplied by .8862. The side of an inscribed square equals the diameter multiplied by .7071.

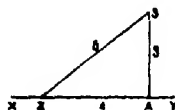
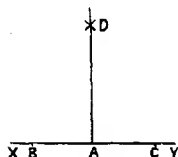
TO LAY OUT A RIGHT ANGLE.

Let A be the point in the straight line XY, from which it is required to lay out a right angle.

1st Method.—Take two points, B and C, in the line XY, at equal distances on either side of A, and from these points as centres, with any convenient radius, describe arcs, cutting each other at D. Then $\angle DAB$ is at right angles to XY.

1st Method.

2nd Method.



2nd Method.—Find a point Z in XY, 4 units distant from A. Then stretch a tape so that BA will be 3 units and BZ 5 units long. Then BA is at right angles to XY.

Note.—The unit in this case may be any convenient measurement, a foot or yard, or multiples of these. The proportion of 3, 4 and 5 is all that is necessary to make right angle.

TO LAY OUT A RIGHT ANGLE WITH MEASURING TAPE.

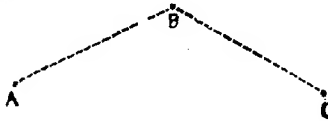
Take a stout pin and drive it through the ring eye at the end of the tape and fix the same to the ground. Run out 16 feet, and at that point put in a second pin, taking care that it be firm and also perpendicular. Next run off 32 feet more making 48 feet altogether and let the 48th foot point exactly touch the first pin, put through the tape ring when starting the operation. Now take up that point in the slack of the tape at the 28th foot on the tape, and move it till it is straight and tight with the first pin and the second, and insert a third pin. This last will therefore be at right angles to the first two, because $16 \times 16 = 256$ and $12 \times 12 = 144$ and $144 + 256 = 400$ of which the square root is 20, vide 47th: Prop: 1. Euclid.

Any like multiples of 3, 4 and 5 for the sides will form a right angled triangle.

out, the diagonals AE and DB will be of equal length, and they will intersect exactly in the middle of the court, which will be a check on the subdivisions.

TO FIND A CENTRE COMMON TO THREE POINTS ON A CURVE.

Suppose the points to be



take a pair of compasses and place one limb on the point B. With a radius greater than half the distance between A and B, sweep a semi-circle on the side nearest to A. With the same radius and with A as a centre describe the arc that will intersect this first semi-circle. The two arcs will intersect above and below the line from A to B. Draw a line through these intersections. Now proceed to draw an arc more than half the distance from B to C with B as a centre. Then with C as a centre, and with the same radius, sweep another arc on the B side of C, and these two arcs will likewise intersect above and below the line from B to C. Draw a line through these intersections and produce it till it cuts the first line. The point where these lines intersect will be the centre common to the points A B and C, as can be proved by using that point as a centre, and the distance from it to say B as a radius, and the circle so drawn will be found to cut all 3 points. The points A B and C, however, should be fairly equidistant.

FOR COMPUTING AREAS FROM A PLAN WITHOUT REDUCING THE FIGURE TO TRIANGLES.

A very simple method is, first to draw on the plan on the same scale a series of parallel lines, each 1 chain apart. At right angles to these draw another series of parallel lines, also a chain apart, the result will be that the figure will contain a number of squares each of which is 1 chain by 1 chain ($\frac{1}{16}$ of an acre). Divide the total number of these squares by 10 and you at once get the total number of acres.

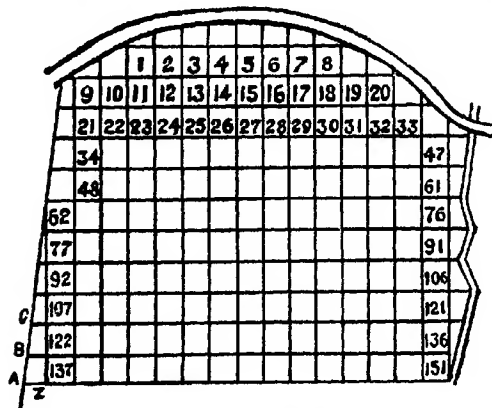
There will however be the difference between the furthest edge of the figure and the nearest edge of the next *complete* square, and the sums of these differences must be added to the sum of the squares to get the total area of the whole figure.

The following illustration (from a plan drawn on the scale of 4 chains to an inch) may be taken as an example.

It will be here seen that we have 151 *complete* squares, to which must be added the area of the incomplete squares on the left, top, and right of the figure.

A most ready and simple method of doing this is as follows, adopting the loss and gain method mentioned in the first part of this article.

Take a piece of clean foolscap paper with straight edges. Let the extreme end of the paper be called zero, or O. Apply the edge of the paper at the zero period, midway between the lines A B and the line of squares T Z and tick off, with a fine pencil, on the edge of the paper



where the line T Z intersects it. Then transfer the paper again midway between the lines B and C, placing the *point* mark on the edge of the paper, against the line B C, and again prick off the intersection as before. Again shift the paper as before, always taking care that the *last* intersection point becomes the zero for the *next* operation, and go all round the figure. The result of this will be that you will have on your piece of foolscap paper, a distance from the zero mark to the last intersection mark, of very nearly 5 inches, or allowing for two little fractions that would come in say, 5 inches. Now on the scale you are working on (4 chains to the inch) these 5 inches equal 20 chains, or obviously 20 squares more. Your figure therefore has—

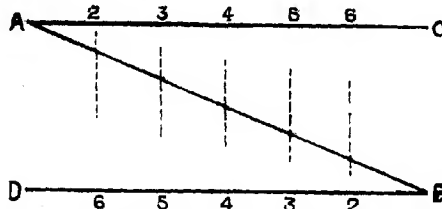
| | | |
|----------------------------------|-----|-------------|
| Complete squares ... | ... | 151 |
| (Offsets) sum of unequal squares | .. | 20 |
| Total ... | | 171 squares |

and as 10 square chains equal one acre, it follows that the area of our figure is 17 acres and 16 perches.

Care must be taken in the dividing of the figure into correct squares, besides the careful application of our *impromptu* paper scale. Use a fine edged scale and a hard, well-pointed pencil, and don't be in too great a hurry!!

TO DIVIDE A LINE INTO A GIVEN NUMBER OF EQUAL DIVISIONS.

Let us suppose that we want to divide the line AB into six equal parts. First draw the line AC at any convenient angle, then from B , draw BD parallel to AC .



With a pair of compasses, prick off 6 equally distant periods along the line AC , shown as $A 2, 3, 4, 5$ and 6 . Start again doing the same thing on the BD line, beginning at B . Finally place the edge of a scale on the point 2 on the AC line, and on 6 on the BD line, and mark its intersection on the line AB , which will be found, when all this is done, to be divided into exactly 6 equal divisions.

This will be found useful when it is necessary to construct scales of definite ratios or proportions.

USEFUL MEMORANDA:

IN COMPUTING INTEREST.

Although there are numerous tables for computing interest at varying rates on both the actual and thirty-day basis, these tables are not always available.

The following rule reduces fractions to a minimum, and makes the computation quick and accurate. It is based on the general rate - 6%—but is easily applied in all cases, by a simple additional step.

Rule: Reduce the years and months to months; annex one-third the number of days; multiply by one-half the principal.

To ascertain 6% interest on £300 for 2 years, 7 months and 21 days. 2 years, 7 months, make 31 months.

Annex one-third the days (one-third of 21) 7—317.

One-half the principal £150 \times .317 = £47.55, or £47 11s.

For each per cent *over* 6 add one-sixth.

For each *under* 6 deduct one-sixth.

TABLE OF INTEREST.

A Table for finding the Interest of any sum of money at any rate of Interest for any number of days. — (*Ceylon Handbook and Directory.*)

| Product. | Rs. | Cts. | Product. | Rs. | Cts. | Product. | Rs. | Cts. |
|------------|-------|------|----------|-----|------|----------|-----|------|
| 50,000,000 | 1,369 | 86 | 100,000 | 2 | 74 | 600 | 0 | 2 |
| 40,000,000 | 1,095 | 89 | 90,000 | 2 | 47 | 500 | 0 | 1 |
| 30,000,000 | 821 | 92 | 80,000 | 2 | 19 | 400 | 0 | 1 |
| 20,000,000 | 547 | 95 | 70,000 | 1 | 92 | 300 | 0 | 1 |
| 10,000,000 | 273 | 90 | 60,000 | 1 | 64 | 200 | 0 | 1 |
| 9,000,000 | 246 | 58 | 50,000 | 1 | 37 | 100 | ... | ... |
| 8,000,000 | 219 | 18 | 40,000 | 1 | 10 | 90 | ... | ... |
| 7,000,000 | 191 | 78 | 30,000 | 0 | 82 | 80 | ... | ... |
| 6,000,000 | 164 | 38 | 20,000 | 0 | 55 | 70 | ... | ... |
| 5,000,000 | 136 | 99 | 10,000 | 0 | 27 | 60 | ... | ... |
| 4,000,000 | 109 | 59 | 9,000 | 0 | 25 | 50 | ... | ... |
| 3,000,000 | 82 | 19 | 8,000 | 0 | 22 | 40 | ... | ... |
| 2,000,000 | 54 | 79 | 7,000 | 0 | 19 | 30 | ... | ... |
| 1,000,000 | 27 | 40 | 6,000 | 0 | 16 | 25 | ... | ... |
| 900,000 | 24 | 66 | 5,000 | 0 | 14 | 15 | ... | ... |
| 800,000 | 21 | 92 | 4,000 | 0 | 11 | 10 | ... | ... |
| 700,000 | 19 | 18 | 3,000 | 0 | 8 | 5 | ... | ... |
| 600,000 | 16 | 44 | 2,000 | 0 | 5 | ... | ... | ... |
| 500,000 | 13 | 70 | 1,000 | 0 | 3 | ... | ... | ... |
| 400,000 | 10 | 96 | 900 | 0 | 2 | ... | ... | ... |
| 300,000 | 8 | 22 | 800 | 0 | 2 | ... | ... | ... |
| 200,000 | 5 | 48 | 700 | 0 | 2 | ... | ... | ... |

RULE—Multiply the principal by the rate; multiply the product obtained by the number of days; then take from the above table the several sums which stand opposite the several parts of the ascertained quotient and add them together for the interest required.

INTEREST—SIMPLE AND COMPOUND.

C = Capital.

i = Rate of interest in decimals of 100. For example, 5 per cent. = .05. $3\frac{1}{2}$ per cent. = .035.

n = Number of years.

S = Sum of capital an interest together after n years

Simple interest $S = C \times i + n$.

To find the time in years in which any sum of money doubles itself at compound interest:— $71 \div$ rate per cent. = years (nearly).

TABLE FOR ASCERTAINING ANY DATE IN THE YEARS 1917-1924.

| | | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 |
|--------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| January ... | 1st 10th 20th | Mon. Wed. Sat. | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. | Sat. Mon. Th. | Sun. Tu. Fri. | Mon. Wed. Sat. | Tu. Th. Sun. |
| February ... | 1st 10th 20th | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Sun. Tu. Fri. | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. |
| March ... | 1st 10th 20th | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Mon. Wed. Sat. | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. |
| April ... | 1st 10th 20th | Sun. Tu. Fri. | Mon. Wed. Sat. | Tu. Th. Sun. | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Sun. Tu. Fri. | Mon. Wed. Sat. |
| May ... | 1st 10th 20th | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. | Sat. Mon. Th. | Sun. Tu. Fri. | Mon. Wed. Sat. | Tu. Th. Sun. | Wed. Fri. Mon. |
| June ... | 1st 10th 20th | Fri. Sun. Wed. | Sat. Mon. Th. | Sun. Tu. Fri. | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. |
| July ... | 1st 10th 20th | Sun. Tu. Fri. | Mon. Wed. Sat. | Tu. Th. Sun. | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Sun. Tu. Fri. | Mon. Wed. Sat. |
| August ... | 1st 10th 20th | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. | Sun. Tu. Fri. | Mon. Wed. Sat. | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. |
| September... | 1st 10th 20th | Sat. Mon. Th. | Sun. Tu. Fri. | Mon. Wed. Sat. | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Sun. Tu. Fri. |
| October ... | 1st 10th 20th | Mon. Wed. Sat. | Tu. Th. Mon. | Wed. Fri. Tu. | Fri. Sun. Th. | Sat. Mon. Fri. | Sun. Tu. Sat. | Mon. Wed. Sun. | Tu. Th. Mon. |
| November ... | 1st 10th 20th | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Mon. Wed. Sat. | Tu. Th. Sun. | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. |
| December ... | 1st 10th 20th | Sat. Mon. Th. | Sun. Tu. Fri. | Mon. Wed. Sat. | Wed. Fri. Mon. | Th. Sat. Tu. | Fri. Sun. Wed. | Sat. Mon. Th. | Sun. Tu. Fri. |
| Xmas Day ... | | Tu. | Wed. | Th. | Sat. | Sun. | Mon. | Tu. | Wed. |

* Leap Year.

| x | 13 | 14 | 15 | 16 | 17 | 18 | x | 19 | 20 | 21 | 22 | 23 | 24 | 25 | x |
|----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|----|
| 13 | 169 | 182 | 195 | 208 | 221 | 234 | 13 | 247 | 260 | 273 | 286 | 299 | 312 | 325 | 13 |
| 14 | 182 | 196 | 210 | 224 | 238 | 252 | 14 | 266 | 280 | 294 | 308 | 322 | 336 | 350 | 14 |
| 15 | 195 | 210 | 225 | 240 | 255 | 270 | 15 | 285 | 300 | 315 | 330 | 345 | 360 | 375 | 15 |
| 16 | 208 | 224 | 240 | 256 | 272 | 288 | 16 | 304 | 320 | 336 | 352 | 368 | 384 | 400 | 16 |
| 17 | 221 | 238 | 255 | 272 | 289 | 306 | 17 | 323 | 340 | 357 | 374 | 391 | 408 | 425 | 17 |
| 18 | 234 | 252 | 270 | 288 | 306 | 324 | 18 | 342 | 360 | 378 | 396 | 414 | 432 | 450 | 18 |
| x | 13 | 14 | 15 | 16 | 17 | 18 | x | 19 | 20 | 21 | 22 | 23 | 24 | 25 | x |
| 19 | 247 | 266 | 285 | 304 | 323 | 342 | 19 | 361 | 380 | 399 | 418 | 437 | 456 | 475 | 19 |
| 20 | 260 | 280 | 300 | 320 | 340 | 360 | 20 | 380 | 400 | 420 | 440 | 460 | 480 | 500 | 20 |
| 21 | 273 | 294 | 315 | 336 | 357 | 378 | 21 | 399 | 420 | 441 | 462 | 483 | 504 | 525 | 21 |
| 22 | 286 | 308 | 330 | 352 | 374 | 396 | 22 | 418 | 440 | 462 | 484 | 506 | 528 | 550 | 22 |
| 23 | 299 | 322 | 345 | 368 | 391 | 414 | 23 | 437 | 460 | 483 | 508 | 529 | 552 | 575 | 23 |
| 24 | 312 | 336 | 360 | 384 | 408 | 432 | 24 | 456 | 480 | 504 | 528 | 552 | 576 | 600 | 24 |
| 25 | 325 | 350 | 375 | 400 | 425 | 450 | 25 | 475 | 500 | 525 | 550 | 575 | 600 | 625 | 25 |
| x | 13 | 14 | 15 | 16 | 17 | 18 | x | 19 | 20 | 21 | 22 | 23 | 24 | 25 | x |

The above table gives, at a glance, the product of any two numbers from 13 to 25 inclusive. Find one of the numbers in one of the vertical lines marked \times and the other in one of the horizontal lines marked \times , and where these lines cross will be found the product. Thus the product of 23×19 will be found to be 437.

The square of each number will be found enclosed in a thick lined space. Thus the square of 21 = 441.

TIMBER MEASUREMENT.

It is required to know the cubical capacity of a log that measures 50 feet in length, and of which the girth at the base is 8 feet, in the middle is 6 feet, and at the end is 4 feet.

Rule :—Reduce all the girths to inches, and add together, and divide the result by the number of times the girth is taken. Divide this result by 4, and square the product.

Multiply the product (squared) by the length of the log in feet and divide by 144 (= the square of one foot in inches) and the remainder will be the cubical capacity required.

Example :—1st: Girth 8 feet = 96 inches.

2nd: do 6 „ = 72 do

3rd: do 4 „ = 48 do

3) 216 = 72 which divided by 4 = 18 or what is called the "Side." $18 \times 18 \times 50$ [length of log in feet $\div 144$] = $112\frac{1}{2}$ cubic feet, or by fractions :—

$50 \times 18 \times 18 = 50 \times \frac{3}{2} \times \frac{3}{2} = 112\frac{1}{2}$ c. ft. the result required.

It is required to know the cubical capacity of 500 Boat planks, each 30 ft. long by 12 inches wide, by 2 inches thick.

Rule :—Multiply the number of planks by the length of each. Multiply result by width and again by thickness and reduce to cubic feet.

Example :— $500 \times 30 = 15,000 \times 1$ (12 inches) $\times \frac{1}{6}$ (2 inches) equals $\frac{15,000}{6}$ or 2,500 cubic feet.

Or by another method :—

Multiply thickness in inches of each plank by number of planks.

This would reduce the 500 to a pile of wood 30 feet long by one foot wide by $83\frac{1}{2}$ feet high.

Then $30 \times 1 \times 83\frac{1}{2} = 2,500$ or the answer required.

Ceylon Sawyer's Measurement.

When the thickness of timber is $1\frac{1}{2}$ inches or less, multiply length in feet by width in inches and divide by 12. When over $1\frac{1}{2}$ inches thick, add width and thickness together and multiply by length, in feet and divide by 12.

TREES TO PLANT.

At Low Elevations.

NATIVE TREES :—

| | | |
|---------------|-----|-----------------------|
| Halmilla | ... | Berrya Emmonilla |
| Wa | ... | Cassia siamea |
| Madatiya | ... | Adenanthera pavonina |
| Kabalmara | ... | Albizzia stipulata |
| Suriyamara | ... | Albizzia odoratissima |
| Lunumidilla | ... | Melia dubia |
| Bomi | ... | Litsea sebifera |
| Gedumba | ... | Trema orientalis |
| Dawul Kurundu | ... | Litsea zeylanica |
| Et-amba | ... | Magnifera zeylanica |
| Pehimbiya | ... | Filicium decipiens |
| Dawata | ... | Carallia integerrima |
| Hal | ... | Vateria acuminata |

FOREIGN TREES :—

| | | |
|--------------------|-----|-------------------------|
| Jak | ... | Artocarpus integrifolia |
| Sapu | ... | Michelia Champaca |
| ..... | ... | Casuarina equisetifolia |
| ..... | ... | Grevillea robusta |
| Balsam of Peru... | ... | Tolmifera Pereire * |
| Rain Tree | ... | Pithecolobium Saman |
| Madras Thorn | ... | Pithecolobium dulce |
| Toon | ... | Cedrela Toona |
| ..... | ... | Pterocarpus indicus |
| Paper Mulberry...* | ... | Broussonetia papyrifera |

At High Elevations.

Ked Toon—cedrela surata
 Cryptomeria japonica
 Eucalyptus—various species
 Acacia Melanoxylon
 Casuarina
 Grevillea
 Wattles—Acacia dealbata and A. decurrens.

CEYLON WOODS.

| Singhalese Name. | Scientific Name. | Approximate measurements per cubic foot. | Suitability. |
|--------------------|--|---|---|
| Alubo | ... <i>Eugenia Sylvestris</i> ... | | Rafters & roofing generally. |
| Amba (Mango) | ... <i>Mangifera Indica</i> ... | 41 | Brake-blocks, Almira's backs. |
| Ankenda | ... <i>Acroneychia laurifolia</i> ... | 48 | Affords an excellent charcoal. |
| Bakmi | ... <i>Sarcocephalus Cordatus</i> ... | 38 | Rafters and wall plates. |
| Bala | ... <i>Nothopegia Colebrookiana</i> ... | | Mine props. |
| Bata-damba | ... <i>Eugenia Operculata</i> ... | 44 | Weather boards spouting rafters. |
| Beraliya | ... <i>Doona Macrophylla</i> ... | | Rafters and wall plates. |
| Bokera | ... <i>Gomphia Angustifolia</i> ... | | Posts for lines. Resists white-ants. |
| Boni | ... <i>Litsea Chinensis</i> ... | | Flooring. |
| Buhora | ... <i>Dipterocarpus Hispidus</i> ... | 46 | Boat planks. Mine planks. |
| Bulu | ... <i>Terminalia Belerica</i> ... | 48 | Temporary work. Scaffolding. |
| Buruta (Satinwood) | ... <i>Chloroxylon Swietenia</i> ... | 56 | Most valuable wood for buildings. A cabinet wood. |
| Damba | ... <i>Eugenia (spp)</i> ... | | For any work exposed to water. |
| Dawata | ... <i>Carallia Intigerrima</i> ... | 48 | Shingles. Dados and ornamental work. |
| Del | ... <i>Artocarpus nobilis</i> ... | 41 | Canoes and Boats. |
| Diya-na | ... <i>Mesua Thwaitesii</i> ... | | Posts, rafters, mine props. |
| Diya-para | ... <i>Wormia triquetra</i> ... | 44 | Dados. Ceilings and panels. |
| Domba | ... <i>Calophyllum Inophyllum</i> ... | 45 | Cart poles. |
| Dorona | ... <i>Dipterocarpus Glandulosus</i> ... | 45 | Floors or lofts. |
| Dun | ... <i>Doona (spp)</i> ... | 68 | Shingles. Rafters. Beams. Sleepers. |
| Gal-mora | ... (see mora) ... | | ... |
| Gammalu | ... <i>Pterocarpus Marsupium</i> ... | 56 | House building. Furniture, panels, &c. |
| Gan-mi | ... <i>Bassia nerifolia</i> ... | 47 | Cart frames. Superior fuel. |
| Gadumba | ... <i>Trema orientalis</i> ... | 30 | For charcoal. |
| Godapara | ... <i>Dillenia retusa</i> ... | 45-50 | Rafters. |
| Go-raka | ... <i>Garcinia Cambogia</i> ... | 50-54 | Posts and props. |
| Gurukina | ... <i>Calophyllum Burmanni</i> ... | 62 | Rafters and Ridge poles. |
| Hal-mendora | ... <i>Stemonoporus Wightii</i> ... | | Wall plates. Roofing. |
| Hal-milla | ... <i>Berrya Ammonilla</i> ... | 56-61 | Gun carriages. Oil casks. A fine wood. |
| Hampalanda | ... <i>Terminalia parviflora</i> ... | | Flooring boards. |

CEYLON WOODS.—Contd.

| Singhalese Name. | Scientific Name. | Approximate weight per cubic foot. | Suitability. |
|------------------|--|------------------------------------|---|
| Hapu | ... <i>Cananga odorata</i> ... | 34 | Ceiling boards. |
| Hadawaka | ... <i>Chaetocarpus castanocarpus</i> ... | 56 | Posts. Beams. Wall plates. |
| Hingul | ... <i>Amoora Rohituka</i> ... | 40 | Shingles. Beams. Rafters. |
| Homoderia | ... <i>Diospyros Thwaitesii</i> (?) ... | | Ornamental wood. |
| Hondapara | ... <i>Dillenia indica</i> ... | 45 | Beams and sleepers. |
| Hora | ... <i>Dipterocarpus Zeylanicus</i> ... | 52 | Boat planks. Beams. Phumbago barrels. |
| Hulan-hik | ... <i>Chickrassia tabularis</i> ... | 45 | Posts. Panels. Window frames. |
| Hunn-kirilla | ... <i>Glochidion Zeylanicum</i> ... | | Temporary works. |
| Kadol | ... <i>Rhizophora mucronata</i> ... | 66 | Ceilings. Affords tannin. |
| Khata | ... <i>Careya arborea</i> ... | 50 | Bridge planks. Yields tannin. |
| Kalumederia | ... <i>Diospyros quæseta</i> ... | 54 | The most valuable cabinet wood in Ceylon. |
| Kaluwara (Ebony) | ... <i>Diospyros ebenum</i> ... | 76 | Ornamental work. |
| Karawu | ... <i>Phyllanthus indicus</i> ... | | Roofing. |
| Kina (Hill sp.) | ... <i>Calophyllum Walkerii</i> ... | 46 | House building generally. |
| Kirikon | ... <i>Walsura Piceidia</i> ... | | Roofing or Beams. |
| Kitul | ... <i>Caryota urens</i> ... | 70 | Spouting. Rafters. Laths. |
| Kokatiya | ... <i>Garcinia termpophylla</i> ... | 78 | Beams. Posts. Piles. |
| Kon | ... <i>Schleichera trijuga</i> ... | 60 | Beams. Cabinet work. |
| Kon (Jackwood) | ... <i>Artocarpus integrifolia</i> ... | 42 | Ceylon's Best building timber. |
| Kohomba | ... <i>Azadirachta indica</i> ... | 50 | Panels. Cabinet work. Hand-some. |
| Kumbuk | ... <i>Taminalia glabra</i> ... | 62 | Sleepers. Beams. Bridge planks. |
| Lawulu | ... <i>Chrysophyllum Boxburghii</i> ... | 40 | Mining timber. |
| Liyan | ... <i>Homalium Zeylanicum</i> ... | 48 | General building work. |
| Luna-madalla | ... <i>Stereospermum Cheilonioides</i> ... | 50 | Flooring boards. |
| Madatiya | ... <i>Adenanthra pavonina</i> ... | 41 | Ceilings. Flooring & Cabinework. |
| Madol | ... <i>Garcinia echinocarpa</i> ... | 50 | Shingles. |
| Mara | ... <i>Albizia Stipulata</i> ... | 42 | Cabinet work. |
| Milla | ... <i>Vitex altissima</i> ... | 52-60 | All forms of building work. |
| Mendora | ... <i>Vatica Roxburghiana</i> ... | 50-60 | Piles or water-resisting work. |
| Mi | ... <i>Bassia Longifolia</i> ... | 62 | Beams. Rafters. Roofing & bridge work. |

GENERAL INFORMATION

31

CEYLON WOODS—(Contd.)

| Singhalese Name. | Scientific Name. | Approximate weight per cubic foot. | Suitability. |
|------------------|--|------------------------------------|--|
| Molpedda | ... <i>Isonandra lanceolata</i> | | Mines and Beams. |
| Mora | ... <i>Nephelium Longana</i> ... | 60 | Rafters. Mine props. |
| Muna-mal | ... <i>Mimusops Elengi</i> ... | 50-60 | Beams and heavy work. |
| Muruta | ... <i>Lagerstroemia Flosreginae</i> ... | 45 | Beams, Roofing, &c. |
| Na (iron-wood) | ... <i>Mesua ferrea</i> ... | 77 | Beams and any heavy work. |
| Na-mendora | ... <i>Surapiti scarbriuscula</i> ... | | Beams, Bridge planks. |
| Na-imbul | ... <i>Pometia eximia</i> ... | 45 | Ceilings. Door frames and rafters. |
| Nedun | ... <i>Pericopsis Mooniana</i> | 70 | Valuable cabinet & furniture wood. |
| Neralu | ... <i>Elaeodendron Glaucum</i> ... | 45 | Cabinet work. |
| Palu | ... <i>Mimusops hexandra</i> ... | 68-80 | All very heavy work. Beams, &c. |
| Panukera | ... <i>Eugenia Neesiana</i> .. | | Rafters. Wall plates. |
| Pat-kela | ... <i>Bridelia Moonii</i> ... | 45 | Beams. Wall plates. Posts. |
| Pehimbia | ... <i>Filicium decipiens</i> ... | 65 | Agricultural implements. Beams. |
| Pelan | ... <i>Kurrimia Zeylanica</i> .. | | Rafters and roof work. |
| Pol (Cocanut) | ... <i>Cocos nucifera</i> ... | 72 | Laths. Ornamental work. |
| Sapu | ... <i>Michelia Champaca</i> ... | 40 | Doors. Frames. Dadoes flooring. |
| Suriya | ... <i>Thespesia populnea</i> ... | 50 | Carriage building. Gun stocks. |
| Suriya-mara | ... <i>Albizia odoratissima</i> | 56 | Furniture & Cabinet work. |
| Towenna | ... <i>Palaquium pitiolare</i> ... | 53 | Beams, Joists, Mine work. |
| Telambu | ... <i>Sterculia foetida</i> ... | 36 | Temporary work only. |
| Tolol | ... <i>Trichadenia Zeylanica</i> | | Temporary work. Mining planks. |
| Ubberia | ... <i>Carallia Calycina</i> ... | 56 | Beams and Buildings. Ornamental work. |
| Wal-buruta | ... (see Wana Sapu) ... | | ... |
| Walukina | ... <i>Calophyllum bracteatum</i> ... | 32 | Ceilings. Cart poles. Window frames. |
| Wauami | ... <i>Bassia fulva</i> ... | 46-51 | Beams. Trusses and Joists. |
| Wana Sapu | ... <i>Michelia nilagerica</i> ... | 40 | Doors. Frames. Ceiling. Handsome. |
| Well-damba | ... (see Damba) ... | | ... |
| Welipianna | ... <i>Anisophyllea Zeylanica</i> ... | 45 | Shingles. |
| Weralu | ... <i>Blaeocarpus serratus</i> | | Pit props or temporary work. |
| Wira | ... <i>Hemicyclia sepiaria</i> ... | | Posts. An excellent fuel. |
| Yaakhalu | ... <i>Doona trapesifolia</i> ... | 60 | Shingles. Beams. Flooring and roofing. |

CEYLON TEA BOX WOODS.

| Singhalese Name. | Scientific Name. | Approximate weight per cubic foot. | Remarks. |
|------------------|---------------------------------------|------------------------------------|---|
| Andunwenna | ... <i>Ilex Wightiana</i> ... | | Fairly suitable for Tea boxes. |
| Arrida | ... <i>Camptosperma Zeylanica</i> ... | 34 | Very good. Works well and clean. |
| Budulla | ... <i>Semecarpus Gardneri</i> ... | 30 | A bad wood. Poisonous. |
| Dawul-kurundu | ... (see Kudu-dowla) ... | | |
| Diyatalia | ... <i>Mastixia tetrandra</i> ... | 46 | Heavy, liable to warp. |
| Etamba | ... <i>Magnifera Zeylanica</i> ... | 32 | Very good but requires careful seasoning. |
| Gona | ... (see Wal-gonna) ... | | |
| Iriya | ... <i>Myristica Iriya</i> ... | 40 | Good but rather heavy. |
| Katnboda | ... <i>Cullenia excelsa</i> ... | 32 | Good. Liable to split. |
| Katuimbul | ... <i>Bombax Malabaricum</i> ... | 24 | Very clean. Pale white. |
| Kekuna | ... <i>Canarium Zeylanicum</i> ... | 27 | Highly scented if not seasoned. |
| Kokun | ... <i>Kokoona Zeylanica</i> ... | | Liable to split. |
| Kududowla | ... <i>Litsea Zeylanica</i> ... | 45 | Excellent but too heavy. |
| Lunumadilla | ... <i>Melia dubia</i> ... | 26 | Very superior. Handsome. |
| Maha-badulla | ... <i>Semecarpus Subpel-tata</i> ... | | A bad and poisonous wood. |
| Malaboda | ... <i>Myristica Laurifolia</i> ... | 24 | Excellent if carefully seasoned. |
| Muguna | ... <i>Tetrameles nudiflora</i> ... | 28 | Very good, fairly even in weight. |
| Ruk | ... <i>Myristica Horsfieldia</i> ... | 15 | Liable to split. |
| Rokettana | ... <i>Alstonia Scholaris</i> ... | 25 | Inferior, often fetid. |
| Tel-kekuna | ... <i>Aleuritis triloba</i> ... | | Pale. Foul smelling. |
| Tinniya | ... <i>Doona congestiflora</i> ... | 36 | Makes a very neat package. |
| Ulalu | ... <i>Machilus macrantha</i> ... | 35 | Handsome package. |
| Urukau | ... <i>Lasianthera apicalis</i> ... | 34 | Fairly good. |
| Wal-billin | ... <i>Ailantus malabarica</i> ... | 24 | A good package if well seasoned. |
| Wal-gonna | ... <i>Ficus callosa</i> ... | ? | Good. Rather heavy. |

HOW TO MAKE CHARCOAL.

There are several methods, but the chief object is the same in all—to produce as much pure wood-carbon as possible with a minimum of ash, and an absence of smoke when burned in air.

The most simple plan is to cut a pit about 8 feet x 6 feet x 6 feet deep, and in it to place the wood in even lengths, placing each piece over the next like cigars in a bundle, taking care to allow space about the middle of the pile in which to lay dry match wood and wood chips. This is best done while the pile in the pit is being made, a sufficient space being left at that end of the pit best suited for igniting the pile.

As soon as the wood in the pile is filled in, up to about a foot from the level of the mouth of the pit, the wood should be most carefully covered with a layer of green leaves, closely laid over the wood. Over this again earth should be put down, but before final closing a small vent hole is left.

The match wood is next lighted, and if the vent arrangement is well made the fire soon spreads to the wood.

The surface of the pit must be watched to check any show of escape of flame or smoke by further addition of soil over the point of leakage.

The time taken for the whole mass to be reduced to charcoal varies very much according to quality of wood and regularity of packing, it may therefore be 36 hours or a third of that time in a state of combustion. This is easily found by removing some of the soil covering the top. If smoke or flame escapes it is evident that the work of combustion is incomplete and must still go on. After all signs of fire or smoke have ceased, the covering matter may be removed and water sprinkled over the mass of charcoal wood, which should by then be perfectly burned and "clean."

To secure the best results, pile together wood of the same kind. If woods of different sorts are mixed, it will be found that one lot is perfectly burned, and the next not touched, because the two different kinds do not carry the same proportion of water, and until the water is driven out by heat charcoal cannot be formed.

The hardest woods as a rule give the best results, as they contain a smaller quantity of water, bulk for bulk, than soft woods. It follows therefore that the dry-zone timbers are best adapted for charcoal making.

The following well-known woods are suitable for charcoal:

Wet-zone Woods—

Doon, Yakkahalu, Nah, Wannaidala, Gallis, Kampotta, Gangmi, Pelang Bokera, Netan, Panukera, Ankenda, and Maditiya.

Dry and Intermediate-zone Woods -

Mora, Ketakela, Kon, Palu, Wira, Katu-kandu, Mora, Neralu, Ehatu, and Gamaulu.

The proportion of weight of charcoal to weight of wood cannot be laid down with certainty, as it is very variable, but an average of 3 bushels of charcoal to one cubic yard of wood may be expected and in many cases exceeded in the case of wet-zone woods, and considerably more from dry-zone timber.

Note—A cooly can burn 80 lbs. charcoal per day.

TO REDUCE LONGITUDE TO TIME.

Rule.—Multiply the degrees, minutes and seconds by 4, and the result = time.

Example.—What is the time corresponding to 50° 31' ?

$$\begin{array}{r} 50^{\circ} \quad 31' \\ \times \quad 4 \\ \hline 3b. \quad 22^{\circ} \quad 4' \end{array} \text{ East Longitude.}$$

For West Longitude subtract the result, as above, from 12 hours. Thus for West Longitude the answer to the above question is 8 hours, 37 minutes, 56 seconds.

TO REDUCE TIME TO LONGITUDE.

Rule.—Reduce the hours to minutes and seconds and divide by 4.

RAINFALL MEMORANDA.

Inches of rainfall $\times 2,323,200$ = cubic feet per square mile.

Do $\times 14\frac{1}{2}$ = millions of gallons per square mile.

Do $\times 3,630$ = cubic feet per acre.

A FORMULA FOR MEASURING RAINFALL.

Pour the rain into any graduated glass—such as an apothecary's glass—the *exact capacity* of which is known either in cubic inches or fluid ounces. If the measure gives fluid ounces, reduce these to cubic inches by multiplying by 1.733. Then the formula for reduction is:— $R = A$ upon $3.1416 \times O^2$. Where R is the rainfall in inches, A the number of cubic inches of rain in the glass, and O the semi-diameter of the funnel in inches, R should then agree with the amount shown by the graduated glass supplied with the gauge.

HARD AND SOFT WATER.

A degree of hardness implies more than one grain of bicarbonate or sulphate of lime per gallon. Each degree of hardness destroys about 1 oz. of soap to every 40 gallons of water used for washing. Less than 6 degrees or 6 grains of mineral substances constitutes "soft" water; above 6 grains "hard" water. Rain water is "soft." Soft water is more economical for washing, cooking, and steam purposes.

Salt water weighs heavier than fresh water, and a cubic foot of ice is lighter than a cubic foot of water.

The average amount of water required by an adult for drinking, washing house purposes, &c., daily, is about 20 gallons.

A horse drinks about 7 gallons daily; a cow drinks about 5 gallons daily; a sheep or pig drinks about 1 gallon daily.

RECIPES.

RUST JOINT CEMENT.

| | Quick. setting. | Slow setting. | | |
|---------|--------------------|------------------|--------------------------------|---------------------------|
| Parts { | 1 | 2 | Sal-ammoniac powder by weight. | } made into a paste |
| | 2 | 1 | Flower of Sulphur | |
| | 80 | 200* | Iron borings. | |

DUBBING.

2 lbs. black resin, 1 lb. tallow, 1 gallon train oil.

TO CURE DRY ROT IN A BUILDING.

Kill the fungus by washing the wood with a strong solution of crude Carbolic Acid, and the unaffected parts and walls adjoining with a saturated solution of sulphate of iron. The causes of damp should be removed and the place ventilated.

TO DESTROY FLIES.

Take one oz. (two tablespoonfuls) of 40 per cent. Formalin and 16 oz. of equal parts of milk and water. Expose in shallow plates, and if you would make it more effectual put a piece of bread in the centre as a decoy. The following is the result of a test made in a large calf barn which was infested with flies. At noon one day 6 plates were placed in a passageway 6 feet x 30 feet. Next morning 3½ quarts of dead flies were picked up in the passage, and it is estimated that 40,000 to 50,000 had been destroyed.

FOR LEAKS IN ZINC OR GALVANISED IRON ROOFS.

White lead, some white sand, and dry pipe-clay, equal parts of each, made into a paste with boiled linseed oil.

PAINTING.

Paint is usually composed of white lead, linseed oil, driers (litharge), a little turpentine, and the colouring pigment, the amount of white lead reduced being in proportion to the amount of colouring pigment added.

For dark colours, boiled oil should be used, especially for outside work.

Knotting should be with patent knotting or with red lead and glue, in equal proportions, applied hot; or knots may be cut out and stopped with putty or hard Japan stopping—the latter for outside work.

The Priming Coat should be composed of white lead, 10 lbs.; red lead, 2 ozs.; driers, 2 ozs.; raw linseed oil, 4 pints.

After the priming coat, holes and cracks should be stopped, and work rubbed down with pumice stone and sandpaper.

Following Coats, omit red lead, add $1\frac{1}{2}$ to 2 pints turpentine instead of an equal quantity of oil, and substitute colouring pigment in proportion required for equal proportion of white lead.

Flatting coat, use turpentine instead of oil.

Outside paint, exposed to sun, should have little or no turpentine.

Clearcole is white lead, water, and size, used on old work, where stained and greasy.

Distemper is made of 112 lbs. whiting, 28 lbs. dry white lead, and 7 lbs. of glue, mixed with boiling water.

Oxide of Iron paint should be used on iron work, the rust being first carefully scraped off. Wrought iron should have all scales and film of oxide carefully removed.

Sanding is throwing fine sand on to wet paint to imitate a stone surface.

Paint for Zinc is composed of 1 part chloride of copper, 1 part nitrate of copper, 1 part sal ammoniac, in 60 parts of water, and add 1 part hydrochloric acid. Paint and leave for 24 hours before applying oil.

Paint on Plaster Walls.—Walls should be thoroughly dry. Water should not be used for cleaning down old work for painting unless absolutely necessary. Plaster may be primed with glue, size, or with 2 or 3 coats of boiled linseed oil, tinged with red lead; applied warm and then sized.

Varnishes.—White enamel, coburg, and French oil varnish on white. Copal or coburg varnish for general work.

Japanning is varnish mixed with ordinary paint.

To remove old Paint, apply 1 lb. soda and $\frac{1}{2}$ lb. of quicklime, mixed to the consistency of cream, and leave for one hour, when the old paint will wash off.

SURFACE PAINT WILL COVER:—

- 1 lb. of paint will cover about $4\frac{1}{2}$ yards first coat, and $6\frac{1}{2}$ yards after.
- 1 lb. of oxide of iron paint will cover 8 to 12 yards on iron.
- 1 gallon of tar and 1 lb. of pitch will cover 12 yards first coat, and 16 to 17 yards after.
- 1 pint of oil varnish will cover 8 to 9 yards.

OXIDE OF IRON PAINT.

| | |
|-----------------|--------------------------------------|
| 11 ounces paint | } to cover a square. (100 sq. feet.) |
| 6 „ linseed oil | |

TO REMOVE OLD PUTTY.

Paint the dry putty with nitric or hydrochloric acid and after about an hour it will have become soft enough to be easily removed : or apply a hot iron, by which it will become soft enough to remove immediately.

STONE GREY WASH FOR WALLS.

(Native Recipe)

| | | |
|-------------------------------|-------------|---------------|
| Lamplack weight 15 ct. pieces | Limc | weight 8 lbs. |
| Dhoby's blue „ 10 „ „ | Glue | „ 1 „ |
| Yellow ochre „ 10 „ „ | Rice congie | „ 1 measure. |

ASBESTOS PAINTS.

| To cover 100 square yards, coats | 1 | 2 | 3 | 4 |
|----------------------------------|----|-----|-----|-----|
| Requires | 94 | 134 | 172 | 208 |

PAINTING QUANTITIES.

A gallon of mixture, or 6 pints of raw linseed oil
 1 „ boiled „ „
 1 „ turpentine
 require from 12 to 14 lbs. of dry paint

| A gallon will cover:— | Superficial feet. |
|------------------------------------|-------------------|
| on stone or brick about | 225-270 |
| on compo or plaster, from | 360-450 |
| on wood | 450-630 |
| on well painted surface or on iron | 720 |
| one gallon of tar, first coat | 108 |
| „ „ „ second coat | 144 |

To make putty for stopping holes and defects in wood—Spanish whiting and linseed oil well beaten kneaded into a stiff paste, or putty 4 lbs. to Pumice stone $\frac{1}{2}$ lb.

Stopping should be done after the priming or first coat.

Priming or first coat, white lead (sometimes mixed with chalk) diluted with linseed oil.

Outside work when not white use mostly boiled oil with a little raw oil. Boiled oil is too dark for pure white, so only a little can be used.

VARNISH FOR WOODS.

(*Singhalese Recipes*)

| | | |
|-------------------------------------|--|---------------------------------|
| 2 lbs. resin | | $\frac{1}{2}$ bottle turpentine |
| 1 $\frac{1}{2}$ bottles linseed oil | | a little arrack |

Before applying varnish, apply coat of linseed oil.

RAT DESTRUCTION.

Stop all visible rat holes with earth, the inhabited holes will then be found to be opened the next day. Into each of the inhabited holes put half-a-teaspoonful of carbon bisulphide. Allow the liquid to evaporate for a few minutes, then apply a lighted torch keeping at the side of the hole when applying torch—the resulting fumes will immediately kill all the rats in the holes. One pound—(Cts. 45) is sufficient for 200 holes.

POOCHIES IN UPHOLSTERED FURNITURE.

Sprinkle powdered hellebore root over the material, rug or carpet, affected.

BELTING.

Belting Memoranda.

Long belts are more effective than short.

Leather Belting:—Occasionally oil with fish oil.

Holes for laces and rivets should be punched with a hollow punch not roughly bored.

AGENTS FOR SOME OF THE BETTER KNOWN BELTINGS.

Redaway's Camel brand belting ... Ceylon Agents—Walker, Sons & Co.
(also "Balata")

Southwark Cotton and Camel Hair

| | | | | |
|------------------------------|-----|-----|----|-------------------------|
| Belting | ... | ... | do | Col. Coml. Co. |
| Balata belting | ... | ... | do | Bosquet & Co. |
| Rosendale's belting | ... | ... | do | Walker & Greig |
| Southwark Manufacturing Co., | | | | |
| "Mars" | ... | ... | do | Walker, Sons & Co. Ltd. |

TO FIND THE WIDTH OF BELTING REQUIRED TO TRANSMIT A KNOWN HORSE POWER.

Let W = width of belt.....
 H P = horse power required to be transmitted
 D = diameter of driving pulley in inches.....
 N = number of revolutions per minute of driving pulley.....
 C = 1,500 for 10 ply belting.....
 C = 2,100 „ 8 „ „
 C = 2,900 „ 6 „ „
 C = 4,300 „ 4 „ „

Then

$$W = \frac{H P \times C}{D \times N}$$

Example:—What width of 8 ply belting would be required to transmit 10 H P., the driving pulley being 30 inches diameter at 100 revolutions a minute.

$$W = \frac{10 \times 2100}{30 \times 100} = 7 \text{ inches.}$$

SCANDINAVIA BELTING.

Ceylon Agents: Eastern Produce & Estates Co., Ltd.

This being solid woven, there are no plies to come apart. The holes for rivets or fasteners should be bored and not punched.

To find the H. P. any width of belt will transmit running at any speed.

Let W = width of belt in inches. $W \times S \times L$

S = speed of belt in feet per minute. Then H.P. = $\frac{\quad}{33000}$

L = working load. 33000

Working Loads = L = 60 for single, 100 for extra stout, 120 for triple.

RELATIVE POWERS.

“Foot-pound” means one pound, raised one foot high, per minute.

One Horse Power (of a Steam Engine) ... 33,000 foot pounds

An Average Horse *22,500 „ „

A Strong Ox *11,250 „ „

A Pony or Mule... .. *10,000 „ „

A Strong Man *2,800 „ „

* These powers are based upon a working day of 8 hours.

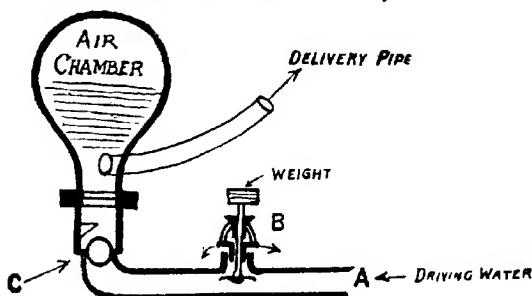
HYDRAULIC CALCULATIONS.

HYDRAULIC RAM.

The ram is a self-acting pump that utilizes the momentum of a fall of water to elevate a part of that water to a height many times the elevation of the fall or supply.

The simple effective operation of this ram and its great durability make it the most useful and economical apparatus yet developed for elevating water and conveying it to almost any desired distance, this distance depending upon the amount of fall available. The use of a ram is practicable where source of supply is but a short distance above ram. The greater the fall, however, the higher the water can be forced.

The water enters through pipe A (see sketch) and escapes through valve B until it has obtained sufficient velocity to raise this valve.



Valve B being now closed the current of water is suddenly stopped and causes an excessive pressure on Valve C, sufficient to raise it and to enter into the air chamber, and thence to the delivery pipe with which the air chamber is in connection.

As the water flows through valve C the pressure upon the valve is lowered and pressure of the air in the air chamber closes it, the water having lost its momentum valve B again opens and allows the water to pass until the velocity is such as to close it and the process is repeated.

It will be seen that the hydraulic ram is entirely self-acting and the cost of upkeep is practically nil—when starting the pump it is necessary to open valve B until the necessary velocity is attained for the 1st stroke.

Rams will work under a head of from 18 to 100 ft. but the more fall available up to about $\frac{1}{3}$ of the height the water has to be raised the less will be the cost of working and the less proportionate quantity of driving water will be required.

In ordinary cases the hydraulic ram returns about 50% of the natural effect. In other words the amount of water raised multiplied by the height above ram will be about 50% of the amount of water driving the ram multiplied by the head of fall between the intake dam and the bottom of ram.

The ram works with anything from 10 to 200 strokes per minute, the useful effect being increased as the height of driving water and strokes is increased within reasonable limits.

The length of the supply pipe conducting the driving water should not be less than 6 times the height of the fall and should be larger where possible.

The ram is capable of delivering water for long distances, distance being of small moment on account of the slow motion of the rising column, causing very little friction.

Table of Results of Hydraulic Rams.

| Number of Strokes per min. | Height of Fall. | Height of Elevation Raised. | Water Expended cub. ft. | Water Raised cub. ft. |
|----------------------------|-----------------|-----------------------------|-------------------------|-----------------------|
| 66 | 10 | 26.3 | 1.71 | .543 |
| 50 | 9.93 | 38.6 | 1.93 | .421 |
| 36 | 6.00 | „ | 1.43 | .169 |
| 31 | 5.00 | „ | 1.29 | .113 |
| 15 | 3.22 | „ | 1.98 | .058 |

In order to ascertain the driving water available to work a ram it is absolutely essential that the head between the intake and the proposed site of ram is ascertained. If the quantity of water is small it should be accurately measured in order that the approximate quantity required at the high level may be calculated.

A special form of ram is made which can be driven by means of a separate supply. The power water may be drawn from a more or less dirty river while the delivery water may come from a clean well or other good supply. In this case valve 'C' takes the form of a plunger or piston and is fitted below the air chamber, and an outlet valve is provided for the dirty water above C, between this latter and the air

chamber a new inlet pipe is provided from the pure water supply, and as the valve or piston C rises and falls, so the pure water is drawn in compressed and discharged through the delivery pipe as before.

Other useful data:—

To calculate the Horsepower of a waterfall.

V = Volume of water flowing in cub. ft. per minute.

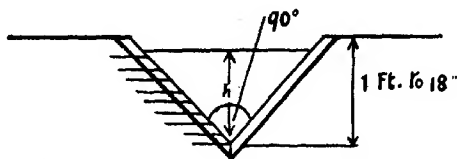
H = Fall in feet.

Horsepower = $.00189 \times V \times H$.

Measurement of Quantity of Water Flowing in a Stream.

When the quantity is small the most accurate method of measurement is by means of the V notch board, when the quantity is larger the water should be measured by means of the rectangular notch. The power gives the most accurate results provided the gauge is carefully made and the readings accurately taken owing to the form of the section of the stream always remaining the same for all heads whereas with the rectangular notch this is not the case.

In the V notch a V should be cut in a straight board, the apex of the V being between 12" and 18" below top of the board or boards. The angle must be exactly a right angle and the edges of the V splayed towards the down stream side to avoid friction when the water is passing the V. (See sketch.)



Fix the board in the stream to be gauged, leaving plenty of room on each side of the V and below the apex to prevent scour, say a foot or so in each case accurately mark on the down stream side of the notch every $\frac{1}{4}$ inch commencing from the apex, and if the stream is not likely to vary greatly, one reading per day may be sufficient from the table the average flow may be obtained. See that the notch is of ample depth so that water does not reach to within an inch or so of the top, and the board must be well puddled with clay round the sides and bottom to prevent leakage.

V NOTCH WEIR TABLE.

From one inch to eighteen inches.

| H. in inches. | 0 | $\frac{1}{8}$ | $\frac{1}{4}$ | $\frac{3}{8}$ | $\frac{1}{2}$ | $\frac{5}{8}$ | $\frac{3}{4}$ | $\frac{7}{8}$ |
|-----------------------------------|-------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Discharge in cub. ft. per minute. | | | | | | | | |
| 1 | ·300 | ·403 | ·522 | ·665 | ·827 | 1·01 | 1·22 | 1·44 |
| 2 | 1·70 | 1·97 | 2·28 | 2·61 | 2·96 | 3·35 | 3·76 | 4·21 |
| 3 | 4·68 | 5·18 | 5·71 | 6·28 | 6·88 | 7·51 | 8·17 | 8·87 |
| 4 | 9·60 | 10·4 | 11·2 | 12·0 | 12·9 | 13·8 | 14·8 | 15·7 |
| 5 | 16·80 | 17·8 | 18·9 | 20·1 | 21·3 | 22·5 | 23·8 | 25·1 |
| 6 | 26·5 | 27·9 | 29·3 | 30·8 | 32·3 | 33·9 | 35·5 | 37·2 |
| 7 | 38·9 | 40·7 | 42·5 | 44·3 | 46·2 | 48·2 | 50·2 | 52·2 |
| 8 | 54·3 | 56·5 | 58·7 | 60·9 | 63·2 | 65·6 | 68·0 | 70·4 |
| 9 | 72·9 | 75·5 | 78·1 | 80·7 | 83·5 | 86·2 | 89·0 | 91·9 |
| 10 | 94·9 | 97·9 | 101 | 104 | 107 | 110 | 114 | 117 |
| 11 | 120 | 124 | 127 | 131 | 135 | 138 | 142 | 146 |
| 12 | 150 | 154 | 158 | 162 | 166 | 170 | 174 | 178 |
| 13 | 183 | 187 | 192 | 196 | 201 | 206 | 210 | 215 |
| 14 | 220 | 225 | 230 | 235 | 240 | 245 | 251 | 256 |
| 15 | 261 | 267 | 273 | 278 | 284 | 290 | 295 | 301 |
| 16 | 307 | 313 | 319 | 326 | 332 | 338 | 344 | 351 |
| 17 | 358 | 364 | 371 | 377 | 384 | 391 | 398 | 405 |
| 18 | 413 | 420 | 427 | 434 | 442 | 449 | 457 | 464 |

Example:—

Find discharge when reading over notch is 11½ inches. See table for 11 inches and under the third column marked $\frac{1}{4}$ will be the required quantity = 127 cub. ft. per minute.

TABLE FOR DISCHARGE OVER RECTANGULAR NOTCH.

| From 12 inches to 24 inches. | | | | |
|------------------------------|-------|---------------|---------------|---------------|
| Inches. | 0 | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ |
| 12 | 16.73 | 17.26 | 17.78 | 18.32 |
| 13 | 18.87 | 19.42 | 19.97 | 20.52 |
| 14 | 21.09 | 21.65 | 22.22 | 22.79 |
| 15 | 23.38 | 23.97 | 24.56 | 25.16 |
| 16 | 25.78 | 26.36 | 26.97 | 27.56 |
| 17 | 28.20 | 28.82 | 29.45 | 30.08 |
| 18 | 30.70 | 31.34 | 31.98 | 32.63 |
| 19 | 33.29 | 33.94 | 34.60 | 35.27 |
| 20 | 35.94 | 36.60 | 37.28 | 37.96 |
| 21 | 38.65 | 39.34 | 40.04 | 40.73 |
| 22 | 41.43 | 42.13 | 42.84 | 43.56 |
| 23 | 44.28 | 45.00 | 45.71 | 46.43 |
| 24 | 47.18 | 47.91 | 48.65 | 49.39 |

The surface of the water on the down stream side should be about a foot below the bottom of the notch, and in the case of the V notch about 6 inches to enable the water to fall clear and not interrupt the flow, and a section of the stream should be selected where the water is not broken up by eddies so that it may approach the weir with a steady flow.

VELOCITY OF PERIPHERY.

v = Velocity of periphery in feet per seconds.

h = Fall of water in feet.

When $h = 5$ feet $v = 7$ feet per second.

| | |
|------------------------------|------------------------------|
| When $h = 10$ feet $v = 6.6$ | When $h = 30$ feet $v = 6.0$ |
| 15 6.2 | 35 4.6 |
| 20 5.8 | 40 4.2 |
| 25 5.4 | 45 3.8 |

When $h = 50$ feet $v = 3.4$.

HORSE POWER.

One Horse Power is the rate of working when 550 lbs. is lifted one foot in one second, or 33,000 lbs. one foot in one minute. It is more than a robust horse can do for any length of time. For a short period, however, a horse can do very much more, but the ordinary work of a horse may be stated as 22,500 lbs. raised one foot in a minute for eight hours a day. One Machinery Horse Power is, therefore, the equivalent of $4\frac{1}{2}$ horses.

$$\begin{aligned} 1 \text{ French, Force de cheval} &= \begin{cases} = 986 \text{ English H.P.} \\ = 75 \text{ Kilogramme Metres.} \end{cases} \\ 1 \text{ German, Pferde Starke} &= \begin{cases} = 735 \text{ Watts.} \\ = 542.5, \text{ ft. lbs. per sec.} \end{cases} \end{aligned}$$

APPROXIMATE HEIGHTS PUMPS MAY BE WORKED TO BY PONY OR HORSE POWER.

The pony or horse in each case being estimated to walk at the rate of 3 miles per hour, and the crank-shaft geared to make 30 revolutions per minute, the pumps being 9 inches stroke.

| Bore of Working Barrels. | | | | 2½ in. | 3 in. | 3½ in. | 4 in. |
|---|--|--|--|---------|---------|---------|---------|
| Single-Barrel Pump worked by Single Pony... | | | | 234 ft. | 165 ft. | 120 ft. | 90 ft. |
| Double-Barrel do do do .. | | | | 117 ft. | 82 ft. | 60 ft. | 45 ft. |
| Treble-Barrel do do do .. | | | | 78 ft. | 55 ft. | 40 ft. | 30 ft. |
| Single-Barrel Pump worked by Single Horse. | | | | 468 ft. | 330 ft. | 240 ft. | 183 ft. |
| Double-Barrel do do do .. | | | | 234 ft. | 165 ft. | 120 ft. | 91 ft. |
| Treble-Barrel do do do .. | | | | 156 ft. | 110 ft. | 80 ft. | 61 ft. |

The above calculations are based upon strong powerful horses or ponies being used; if inferior animals are substituted the heights given will, of course, not be attained.

Five bullocks are estimated to equal two horses in power, but they do not, as a rule, walk at the rate of more than $1\frac{1}{2}$ miles per hour.

TABLE OF THE POWER REQUIRED TO RAISE WATER FROM DEEP WELLS.

| Diameter of Pump Barrel. | Description of Pump. | Quantity of Water raised per Hour. | Maximum Depth from which this Quantity can be raised by each unit of Power. | | | |
|--------------------------|----------------------|------------------------------------|---|---------------------------|--------------------------|-------------------------------|
| | | | One Man turning a Crank. | One Donkey Working a Gin. | One Horse Working a Gin. | One Horse Power Steam Engine. |
| Inches. | Double Action | Gallons. | Feet. | Feet. | Feet. | Feet. |
| 2 | Lift | 225 | 80 | 160 | 560 | 880 |
| 2½ | | 360 | 50 | 100 | 350 | 550 |
| 3 | and | 520 | 35 | 70 | 245 | 385 |
| 3½ | Force Pump | 700 | 25 | 50 | 175 | 275 |
| 4 | | 900 | 20 | 40 | 140 | 220 |

WATER WHEELS AND TURBINES.

Letels Weir Tables. From ¼ inch depth to 25 inches depth.

| Inches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Inches |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| | .01 | .05 | .09 | .14 | .20 | .26 | .33 | | |
| 1 | .40 | .47 | .55 | .65 | .74 | .83 | .93 | 1.03 | .40 |
| 2 | 1.14 | 1.24 | 1.36 | 1.47 | 1.59 | 1.71 | 1.83 | 1.96 | 1.14 |
| 3 | 2.09 | 2.23 | 2.36 | 2.50 | 2.63 | 2.78 | 2.92 | 3.07 | 2.09 |
| 4 | 3.22 | 3.37 | 3.52 | 3.68 | 3.83 | 3.99 | 4.16 | 4.32 | 3.22 |
| 5 | 4.50 | 4.67 | 4.84 | 5.01 | 5.18 | 5.36 | 5.54 | 5.72 | 4.50 |
| 6 | 5.90 | 6.09 | 6.28 | 6.47 | 6.65 | 6.85 | 7.05 | 7.25 | 5.90 |
| 7 | 7.44 | 7.64 | 7.84 | 8.05 | 8.25 | 8.45 | 8.66 | 8.86 | 7.44 |
| 8 | 9.10 | 9.31 | 9.52 | 9.74 | 9.96 | 10.18 | 10.40 | 10.62 | 9.10 |
| 9 | 10.86 | 11.08 | 11.31 | 11.54 | 11.77 | 12.00 | 12.23 | 12.47 | 10.86 |
| 10 | 12.71 | 13.95 | 13.19 | 13.43 | 13.67 | 13.93 | 14.18 | 14.42 | 12.71 |
| 11 | 14.67 | 14.92 | 15.18 | 15.43 | 15.67 | 15.96 | 16.20 | 16.46 | 14.67 |
| 12 | 16.73 | 16.99 | 17.26 | 17.52 | 17.78 | 18.05 | 18.32 | 18.58 | 16.73 |
| 13 | 18.87 | 19.14 | 19.42 | 19.69 | 19.97 | 20.24 | 20.52 | 20.80 | 18.87 |
| 14 | 21.09 | 21.37 | 21.65 | 21.94 | 22.22 | 22.51 | 22.79 | 23.08 | 21.09 |
| 15 | 23.38 | 23.67 | 23.97 | 24.26 | 24.56 | 24.86 | 25.16 | 25.46 | 23.38 |
| 16 | 25.76 | 26.06 | 26.36 | 26.66 | 26.97 | 27.27 | 27.58 | 27.89 | 25.76 |
| 17 | 28.20 | 28.51 | 28.82 | 29.14 | 29.45 | 29.76 | 30.08 | 30.39 | 28.20 |
| 18 | 30.70 | 31.02 | 31.34 | 31.66 | 31.98 | 32.31 | 32.63 | 32.96 | 30.70 |
| 19 | 33.29 | 33.61 | 33.94 | 34.27 | 34.60 | 34.94 | 35.27 | 35.60 | 33.29 |
| 20 | 35.94 | 36.27 | 36.60 | 36.94 | 37.28 | 37.62 | 37.96 | 38.31 | 35.94 |
| 21 | 38.65 | 39.00 | 39.34 | 39.69 | 40.04 | 40.39 | 40.73 | 41.09 | 38.65 |
| 22 | 41.43 | 41.78 | 42.13 | 42.49 | 42.84 | 43.20 | 43.56 | 43.92 | 41.43 |
| 23 | 44.28 | 44.64 | 45.00 | 45.38 | 45.71 | 46.08 | 46.43 | 46.81 | 44.28 |
| 24 | 47.18 | 47.55 | 47.91 | 48.28 | 48.65 | 49.02 | 49.39 | 49.78 | 47.18 |

(See next page.)

Explanation of the Weir Table on page 46.

The foregoing table gives the number of cubic feet of water passing per minute over a weir for each inch breadth, from $\frac{1}{8}$ of an inch in depth to 25 inches depth. The figures 1, 2, 3, etc., in the first and last perpendicular columns, are the inches depth of water over weir, while the first or top horizontal column represents fractional parts of an inch, from one-eighth to one inch. The body of table shews the cubic feet and decimal parts of a cubic foot that will pass each minute for each depth of weir, from one-eighth to twenty-five inches, as before stated. But each result is for but one inch in width; so, for any particular number of inches breadth of weir the result obtained in table must be multiplied by the number of inches of breadth the weir may be. For example, suppose the notch or weir be 20 inches wide, and the water $5\frac{1}{8}$ inches deep; in the first or last column find the figure 5, follow the horizontal column until the perpendicular column is reached containing $\frac{1}{8}$ at the top. In the square where these two columns meet will be found 5.18 (five and eighteen hundredths) cubic feet. This is the quantity of water that will pass for each inch in width; but, since the supposed weir was 20 inches wide, this result must be multiplied by 20, which gives 103.60 (one hundred and three and sixth-tenths) cubic feet per minute.

TO FIND THE POWER OF WELL-MADE TURBINES.

Multiply the cubic feet of water per minute by the height of the fall, and divide by 700; the quotient will be the horse-power of the wheel.

TO FIND THE EFFECTIVE POWER OF A WATER-WHEEL.

Multiply the quantity of water expended in cubic feet per second by the effective height of the fall in feet, and divide the product by one of the following divisions:—viz., 11.7 for "High Breast" Water Wheels; 13 for "Overshot"; 15 for "Breast" and 22 for "Undershot" Water Wheels.

Example:—Required the effective horse-power of a "High Breast" Water Wheel requiring 20 cubic feet water per second, the effective height of fall being 29 feet 3 inches, then

$$\frac{20 \times 29.25}{11.7} = 50 \text{ effective horse power}$$

**TO FIND THE HORSE-POWER THAT MAY BE DEVELOPED BY A WELL-
MADE WATER WHEEL.**

D = diameter of Water Wheel in feet.

W = width of buckets in feet.

ds = depth of shrouding (radial depth of bucket) in feet.

v = velocity of periphery in feet per second.

$$\text{Horse Power} = \frac{D \times W \times ds \times v}{24}$$

TABLE OF STRENGTH OF COMMON ROPES.

Rule.—Multiply the square of the circumference in inches by .08, the product is the working load. Or, multiply the square of the circumference in inches by .2, the product is the breaking strength in tons.

| Circum- ference. | Working Load. | | | | Breaking Load. | | |
|---------------------|---------------|-------|------|------|----------------|-------|------|
| | Tons. | cwts. | qrs. | lbs. | Tons. | cwts. | qrs. |
| 2 | 0 | 6 | 1 | 17 | 0 | 16 | 0 |
| 2½ | 0 | 8 | 0 | 11 | 1 | 0 | 0 |
| 2½ | 0 | 10 | 0 | 0 | 1 | 5 | 0 |
| 2¾ | 0 | 12 | 0 | 11 | 1 | 10 | 1 |
| 3 | 0 | 14 | 0 | 6 | 1 | 16 | 0 |
| 3¼ | 0 | 16 | 3 | 17 | 2 | 2 | 1 |
| 3½ | 0 | 19 | 2 | 11 | 2 | 9 | 0 |
| 3¾ | 1 | 2 | 2 | 0 | 2 | 16 | 1 |
| 4 | 1 | 5 | 2 | 11 | 3 | 4 | 0 |

TABLE OF STRENGTH OF CHAINS.

Rule.—Divide the square of the diameter in eighths of an inch by 10, the product is the working load in tons. Or, multiply the square of the diameter in sixteenths of an inch by 10, the product is the breaking strength in tons.

| Diameter of Iron in Link. | Working Load. | | | Breaking Load. | | |
|---------------------------------|---------------|-------|------|----------------|-------|------|
| Inch. | Tons. | cwts. | qrs. | Tons. | cwts. | qrs. |
| ½ | 0 | 8 | 2 | 1 | 13 | 1 |
| ⅝ | 0 | 12 | 2 | 2 | 10 | 0 |
| ¾ | 0 | 18 | 0 | 3 | 12 | 0 |
| 7⁄8 | 1 | 4 | 2 | 4 | 18 | 0 |
| 1 | 1 | 12 | 0 | 6 | 8 | 0 |
| 1¼ | 2 | 0 | 2 | 8 | 2 | 0 |
| 1½ | 2 | 10 | 0 | 10 | 0 | 0 |
| 1¾ | 3 | 12 | 0 | 14 | 8 | 0 |

PREVENTION OF SCALE IN BOILERS.

Chemical compounds poured into a boiler are of no use in either removing scale or preventing its formation, and many of them are injurious to the plates. The mineral matter forming scale is first precipitated in a boiler in the form of powder, or sludge, and it should be removed before it has time to deposit on the plates and harden to form scale; this may be effected by partial blowing off. The formation of scale may be prevented by blowing off the water from stationary boilers, for a few minutes before stirring up the fires in the morning and before banking them at night, with the pressure of the steam at about 5 lbs. per square inch.—*The Practical Engineer.*

A further prevention of the adhesion of deposit to the inside of the boiler will be found in the application of common soda. The quantity which may be used with advantage is 1 lb. for an 8 H. P. boiler, 2 lbs. for a 16 H. P. (and so on in proportion), per week; the soda should be first dissolved in hot water, and the latter emptied by proportions into the feed water-tank, say one-third at a time, the soda is thereby mixed with the water and duly forced into the boiler by the feed pump: it largely prevents the incrustation of any ingredients on the inside surface, and by periodically blowing out, the injurious sediment is removed altogether. It is a remedy easily procured and readily applied, is very effectual, and produces no deteriorating effect on the tubes or plates.—*The Ceylon Tea-Makers' Hand-Book.*

Note—Every boiler must be examined once a year by a qualified Engineer and may be tested with water pressure to one and a half times its ordinary working steam pressure by the Engineer, should he consider such test necessary.

CARE OF BOILERS.

- (1) Warm boiler gradually. Do not get up steam from cold water in less than four hours.
- (2) Moderately thick fires are most economical. Fire evenly and regularly, a little at a time. Do not clean fire oftener than necessary, and keep fire door open as short a time as possible.
- (3) Cleaning must be done thoroughly inside and outside. The frequency of cleaning will depend upon the nature of fuel and water but the boiler ought to be opened at least every two months.
- (4) Never fill a hot boiler with cold water.
- (5) The dirty water should be blown off every morning; allow the cock to stand open for two or three minutes when the steam pressure is about 5 lbs.

- (6) If the boiler is not required for some time, fill full of water containing a quantity of common washing soda; or fill nearly full and pour on this a quantity of crude petroleum, and then run out water.
- (7) Gauge cocks and water gauges must be kept clean. Water from gauge glass should be blown at least twice a day. If the water does not return quickly to the glass the connections require cleaning, which can be done with a wire. It does not follow that there is plenty of water in the boiler, because it shows in the glass, hence the importance of blowing through the gauge cocks frequently.
- (8) Lift each safety valve by hand in the morning to see that it is free.
- (9) Do not empty the boiler under steam pressure, but cool it down with the water in, then open the blow-out cock and gauge glass cocks which will admit air and so prevent a vacuum forming in the boiler.
- (10) Check valves and self-acting feed valves should be frequently cleaned. Get the feed valves so as to give a constant supply and keep the water up to say half glass.
- (11) In case of low water, immediately cover the fire with ashes and earth, wet if possible, and open furnace door. Draw fire as soon as it can be done without increasing the heat. Never turn on, feed, start, or stop the engine, or lift safety valve, but let boiler cool.
- (12) The principal points to be observed in the care of engines are to keep all wearing parts well oiled, and in thorough repair, and thoroughly clean: everything about an Engine and Boiler Room should be kept clean and tidy; dirt increases the wear and tear and often hides faults which would be otherwise noticed.
- (13) Should engine not be required for a short time, the fly wheel should be turned through one or two revolutions every day.

OIL AND LIQUID FUEL ENGINES.

| Name of Manufacturers. | | Local Agents. |
|-----------------------------------|-----|-------------------------------------|
| Westinghouse B. Co., London, | | |
| "Cross Patent" Engine | ... | Hoare & Co. |
| Davey Paxman & Co. | ... | } Talawakelle Engineering Works. |
| Diesel | ... | |
| Sulzer Bros. | ... | |
| Ruston Proctor & Co. | ... | Walker & Greig, Ltd. |
| Hornsby Akroyd | ... | } Brown & Co. |
| Hornsby | ... | |
| "National" | ... | Walker, Sons & Co. |
| "Bates" | ... | Eastern Produce & Estates Co., Ltd. |
| "Petter" | ... | W. H. Davies & Co. |
| Tangye, Ltd., Semi-Diesel Engines | ... | Colombo Commercial Co., Ltd. |

STEAM ENGINES.

| | |
|-------------------------------------|--------------------------------|
| Brit. Westinghouse Electric Co. ... | Hoare & Co. |
| Davey Paxman & Co. ... | Talawakelle Engineering Works. |
| Robey & Co., Lincoln ... | Colombo Commercial Co. |
| Ruston Proctor & Co. ... | Walker & Greig, Ltd. |
| Marshall Sons & Co. Ltd. ... | Walker Sons & Co., Ltd. |

WATER TURBINES.

| | |
|--|-------------------------|
| Brit. Westinghouse Electric Co. (for any fall) ... | Hoare & Co. |
| W. Gunther & Sons, Oldham (for any fall) ... | Colombo Commercial Co. |
| C. C. C. Pelton Wheels ... | " " |
| Gunther & Sons, Turbines & Pelton Wheels (for any fall) ... | Walker & Greig, Ltd. |
| Gilbert Gilkes & Co. ... | Walker Sons & Co., Ltd. |

SUCTION GAS ENGINES AND PLANTS.

| | |
|---|-------------------------------------|
| Brit. Westinghouse Electric Premier Gas Engines Co. coupled to Salmon Whitfield's patent producer for any fuel and waste products ... | Hoare & Co. |
| Davey Paxman & Co. ... | Talawakelle Engineering Works. |
| Tangyes, Ltd., Engines for Coke, Charcoal or Refuse Fuels ... | Colombo Commercial Co. |
| Ruston Proctor & Co. ... | Walker & Greig, Ltd. |
| Hornsby, Ltd. ... | Brown & Co. |
| "Bates" ... | Eastern Produce & Estates Co., Ltd. |
| "National" ... | Walker, Sons & Co. |

OXY-ACETYLENE WELDING.

During the last few years the above process of repairing damaged machinery or parts has been successfully introduced into Ceylon.

This method consists of the fusion and intermolecular combination of the two edges or faces of metal to be joined, caused by the extreme heat generated in the oxy-acetylene flame, the temperature* being calculated at 4000°C or over 7000°F. In all cases this flame can melt lime, the melting point of which is estimated at 3000°C, and this can only be obtained otherwise in the electric arc.

A large and complete Oxy-Acetylene Plant is installed in the Works of Messrs. Walker, Sons & Co., Ltd., and anyone who is interested can, by appointment, inspect the plant in operation.

A small auxiliary plant is also available for sending to any place in the Island for repairs to be effected on the spot, in cases where it is impossible or inconvenient for the damaged parts to be sent to Colombo.

BUILDING NOTES.

(1 square = 100 square feet.)

SUN-DRIED BRICKS.

These are usually made in a mould $12'' \times 6'' \times 6''$ and when dry shrink to about $11\frac{1}{4}'' \times 5\frac{1}{4}'' \times 5\frac{1}{4}''$; they should be composed of puddled clay with some sand in it, if sand is lacking straw may be added as it helps to bind but where there are white ants straw should be avoided. The bricks should not be made of surface soil. When first made the brick weighs about 24 lbs. and after exposure to sun and air for about six weeks it should be thoroughly dry and will then weigh about 14 lbs.

Sun-dried bricks are best suited to rough work but if well made and well dried they can be used for interior walls in a bungalow, they should not be used for outside walls unless protected from rain.

The cost of walls built of these bricks is Rs. 15 to Rs. 16 per 1,000 bricks in Uva where, as in other dry parts of Ceylon, they are much used.

Sun-dried bricks are not suited to damp climates as they cannot be thoroughly dried.

BRICKLAYERS' AND BUILDERS' MEASUREMENTS.

London Stock brick $8\frac{1}{2} \times 4\frac{1}{2} \times 2\frac{1}{2}$ weight 6.8 lbs.

Ceylon Stock „ $8\frac{1}{2} \times 4\frac{1}{2} \times 2\frac{1}{2}$ „ 5 „

London facing „ $9\frac{1}{2} \times 4\frac{1}{2} \times 2\frac{1}{2}$ „ 7.5 „

Welsh fire brick $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ „ 7.8 „

1,000 London Stock bricks, stacked ... = 56 feet cube.

1,000 Ceylon „ „ „ ... = 48 „ „

1,000 Old Ceylon Stock bricks cleaned and stacked ... = 62 „ „

Ceylon made bricks will absorb $\frac{1}{4}$ of their bulk of water.

Brickwork is measured by the cube = 100 cubic feet.

One cube of Ceylon brickwork will require 1,700 bricks.

„ „ „ „ „ 30 cubic feet of mixed mortar. Mixed one part slaked lime to two parts sand, this mortar will require 12 cubic feet of lime and 24 cubic feet of sand, as a large portion of the lime will lie in the interstices of the sand.

A London bricklayer with two navvies will lay up to 1,400 bricks in a day.

A Ceylonese bricklayer with two coolies will lay between 250 and 400 bricks in a day.

MINIMUM THICKNESS OF BRICK WALLS.

When the height does not exceed 30 feet, and the length between party walls does not exceed 35 feet, the thickness may be $1\frac{1}{2}$ bricks up to 20 feet, and the remainder 1 brick.

If the height does not exceed 20 feet, and the length between party walls does not exceed 30 feet, the whole wall may be built 1 brick thick.

FOUNDATION OF BRICK WALLS.

Foundations should have a width at the base equal to twice the thickness of the wall, diminishing in regular offsets; and a height equal to one-half the width of the base.

Whenever the building is over 5 feet high and scaffolding is required about 1% should be added in the estimated cost:—

In the case of plastering this should not be added until there is a 7 ft. lift.

SAFE BEARING POWER OF SOILS.

| Kind of Material. | Bearing power in lbs. per sq. ft. | |
|---|--------------------------------------|----------|
| | Minimum. | Maximum. |
| Rock, hardest, in thick layers in natural bed ... | 400,000 | — |
| Rock equal to best Ashlar masonry ... | 50,000 | 60,000 |
| “ “ “ brickwork ... | 30,000 | 40,000 |
| “ “ “ poor “ ... | 10,000 | 20,000 |
| Clay in thick beds, always dry ... | 8,000 | 12,000 |
| “ “ “ moderately dry ... | 4,000 | 8,000 |
| Clay, soft and made ground ... | 2,000 | 4,000 |
| Gravel and coarse sand, well compacted ... | 16,000 | 20,000 |
| Sand compact “ “ “ “ ... | 8,000 | 12,000 |
| Sand, clean dry “ “ “ “ ... | 4,000 | 8,000 |
| Quick sand, Alluvial sands, etc. ... | 1,000 | 2,000 |

SAFE PRESSURE ON BRICKWORK AND CONCRETE.

(London Building Act).

| | |
|--|---------------------|
| Blue brick in cement mortar ... | 12 tons per sq. ft. |
| Hard brick (including London Stock) in cement mortar | 8 “ “ |
| Ordinary brick in cement mortar ... | 5 “ “ |
| Portland cement, plain concrete in foundations ... | 15 “ “ |

FOUNDATIONS TO COLUMNS AND STANCHIONS.

Safe Load of stone base determines the area of base flange, but larger often advisable, to give lateral steadiness.

Practical limit to size of stone base 4 ft. \times 4 ft. and 2 ft. deep. If larger required, then cast iron base plate bedded direct on concrete or brick foundation. Portland cement should always be used in foundations to piers.

Thickness of bed should be $1\frac{1}{2}$ times the projection of the stone beyond the column base, the thickness of concrete should be twice the projection beyond the stone.

MORTAR.

Ordinary composition, 1 of lime to 2 of sharp river sand.

1 bushel quicklime weighs 64 lbs.

1 „ sand weighs—145 lbs.

MASON.

100 cubic feet of mason work requires 77 cubic feet of stone and 15 bushels of mortar.

When built in courses masonry requires per cubic yard, 35 cubic feet of stone and $6\frac{1}{2}$ cubic feet of mortar.

Or 100 cubic feet requires 130 cubic feet of stone and 20 bushels of mortar.

MORTARS AND CEMENTS.**Proportions to use.**

Lime, 1 part ; Portland cement, 1 part ; sand 6 to 8 parts. Cheaper and better than usual mortar. Lime slaked 24 hours, mixed with sand for 10 minutes, cement added, whole ground and used at once.

Selinitic Cement, 1 part ; Sand, 5 or 6 parts. A superior mortar about the same cost as usual mortar. Selinitic cement should be mixed with water before adding the sand ; in this respect it differs from other limes and cements.

Selinitic Cement, 1 part ; Portland Cement, $\frac{1}{2}$ part ; Sand, 8 parts.

Portland Cement, 1 part ; Sand, 2 or 3 parts. If in water : Portland Cement, 1 part ; Sand, 1 part.

Roman Cement will only carry $1\frac{1}{2}$ times its own bulk of sand. 1 to 1 usual proportions.

Blue or Black Mortar : Lime, 1 part ; Blacksmith's Ashes, sifted fine, 3 parts. Or Lime, 3 parts ; Ashes, 2 parts ; Sand, 4 parts. Or Portland Cement, 1 part ; Ashes, 4 parts. Furnace Slag, Iron Scorie, and Coal Cinders also used.

Mortar for Flues.—Cow dung, 1 part ; Hair Mortar, 4 parts.

CEMENT.

Portland cement is composed of clayey mud and chalk ground together and afterwards calcined at a high temperature; after calcining it is ground to a fine powder.

Cement.—1 of sand to 1 of cement; use without sand if great tenacity is required.

Portland cement improves by age if kept from moisture.

The longer it is in setting the stronger it will be.

Strong cement is heavy; blue grey, slow setting.

Quick setting cement has generally too much clay in its composition—is brownish and weak.

The less water used in mixing cement the better.

Bricks, used with cement, should be well soaked.

Cement setting under *still* water will be stronger than if kept dry.

Salt water is as good as fresh for mixing cement.

CONCRETE CEMENT.

Quality of Cement per Cubic Yard.

| Proportions. | Weight of Cement. | | Casks. |
|--------------|-------------------|--------|--------|
| 1 in 10½ | ... | 2 cwt. | 0.60 |
| 1 in 8 | ... | 2½ " | 0.70 |
| 1 in 7 | ... | 3 " | 0.90 |
| 1 in 6 | ... | 3½ " | 1.05 |

One cubic yard (1½ inch broken stone) and one cubic yard sand, when mixed = 1½ cubic yards concrete.

The adding of cement does not increase the bulk.

CEMENT PLASTERING.

Cement Required to Cover 1 Square, i.e. 100 Square Feet.

| | 1 inch thick. | | ½ inch thick. | | ¼ inch thick. | |
|---------------------|---------------|--------|---------------|--------|---------------|--------|
| | Bush. | Casks. | Bush. | Casks. | Bush. | Casks. |
| Pure cement | 8½ | 2½ | 7 | 2 | 4½ | 1½ |
| 1 cement and 1 sand | 4½ | 1½ | 3½ | 1 | 2½ | ¾ |
| 1 do 2 do | 3½ | 1 | 2½ | ¾ | 1½ | ½ |

USEFUL INFORMATION.

1 cask cement will point 400 square feet of brickwork.

1 cask weighs ... gross lbs. 400

Do ... = tare lbs. 82½

Do ... = net lbs. 375

1 cask contains ... Cubic feet 3½

Do loose cement ... do = 4½

Do do ... bushels 3.4

| | |
|--|----------------|
| 1 bushel weighs | lbs. 110 |
| 1 cubic foot = | lbs. 85·7 |
| 1 bushel = 1·284 cubic feet = 8 gallons = 2 kerosine oil tins. | |
| 1 bushel of lime, unslaked . . | weighs 64 lbs. |
| 1 bushel of sand | 122 „ |
| 1 cask of Portland cement contains 3·4 bushels = 4·37 cube ft. = | 375 lbs. |
| 1 ton of Portland cement = | 6 casks. |
| 6½ gallons = | 1 cubic foot. |

TO ENABLE PORTLAND CEMENT TO STAND HEAT IN FURNACE WORK.

Mix with common salt in the proportions of 5 of salt to 6 of cement, and use as ordinary mortar.

CONCRETE FLOORS, ETC.

A good standard mixture consists of the following :—

| | | |
|-----------------------|-------------------------------|--|
| 6 parts broken metal. | } requires one cubic yard. | 27 cubic feet metal. |
| 2 „ sand. | | 7 bushels sand. |
| 1 „ Portland cement. | | 3·51 bushels cement. 2 gallons water. |

Lime concrete is not a success in the low-country, but if used, twice as much lime is required as is specified for cement in above mixture.

100 square feet of 4' concrete require :—

| | | |
|-------|-----------------------|---------------|
| 33 | cubic feet of metal = | 25·7 bushels. |
| 8·55 | bushels sand, | |
| 4·27 | „ cement. | |
| 30·55 | gallons of water. | |

The adding of cement and sand to the broken metal does not increase the bulk in concrete. The broken metal for concrete should pass through a 1½" ring. It is advisable to lay concrete when on sand or in very damp situations, on 6 inches of rough stone paving.

When mixing concrete the sand and cement should be mixed together first and then added to the metal, and the whole mixed together thoroughly while dry till of a uniform colour throughout. The water should then be added slowly, mixing all the time till all is of a uniform mixture and colour. It is best to mix concrete on boards.

In laying a concrete floor, the coolies, etc., should not be allowed to walk over the portions laid as the grease and dirt thereby deposited prevent the ½ in. cement and sand from properly keying to the concrete, and it eventually scales off.

A concrete floor should be kept wet for at least a week, so as to prevent drying on the surface and consequent cracking. Wet sacks or wet sand are best for this.

The cleaner and sharper the sand the greater the strength. Sand should be washed till it leaves no mark on a clean white cloth.

It is better to finish off a job the same day if possible.

Asphalte for floors, roofs, damp-proof courses, walls, arches, tanks, reservoirs, etc., is used in a mastic state and rubbed to a smooth surface,

Thickness: For floors and roof, $\frac{1}{4}$ in. to 1 in.; for pavements and roads, $1\frac{1}{2}$ in. to 2 in.; for damp-proof courses, $\frac{1}{2}$ in. to $\frac{3}{4}$ in.; and as a vertical damp-proof courses, $\frac{3}{4}$ in. to $1\frac{1}{2}$ in.

The bed for receiving Asphalte must be thoroughly dry, and where it is to be attached to vertical faces, the surface should be rough to afford a good key.

CEMENT PLASTER.

100 square feet cement plaster $\frac{3}{4}$ " thick require:—
3·24 bushels sand. 1·62 bushels cement.

LIME PLASTER TO WALLS.

For 100 square feet rendered and set, $\frac{3}{4}$ " thick require:—
Lime, unslaked, 2 bushels. Sand, 2 bushels.
The lime should be well slaked before using.

TO GIVE CEMENT FLOORS THE APPEARANCE OF BLACK MARBLE.

Dissolve Permanganate of Potash in water; sprinkle freely over floor and spread evenly with broom. Allow to dry. Let this be done three consecutive days, then wash with warm water. After interval of one week repeat treatment for two days. Again wash with warm water. After a further interval of at least three days apply bees-wax sparingly and polish with coconut husk or stiff broom.

CEMENT FOR IRON.

Take equal parts of sulphur and white lead with about a sixth of borax; incorporate the three so as to form one homogeneous mass. When about to apply, wet with strong sulphuric acid, and place a thin layer of it between the two pieces of iron, which should then be firmly pressed together. In five days it will be perfectly dry, all traces of the cement having vanished, and the iron will have the appearance of having been welded together.

CEMENT FOR DRIERS.

| | |
|------------|-------------------|
| 3 of chalk | } mix with water. |
| 1 of salt | |

CORAL LIME, CEYLON.

| | | | | |
|-------------|-----|------------------------|-----|----------|
| In Shell | .. | 1 heaped bushel weighs | ... | 82 lbs. |
| | ... | 1 cut | do | 73 lbs. |
| Quick Lime | ... | 1 heaped | do | 72 lbs. |
| | ... | 1 cut | do | 64 lbs. |
| Slaked Lime | ... | 1 heaped | do | 112 lbs. |
| | ... | 1 cut | do | 100 lbs. |

1 bushel quick lime gives 2·60 bushels slaked lime.

A heaped bushel is one-fifth greater than a cut bushel.

About ninety cubic feet of firewood are required to burn 35 cubic feet of lime.—(Ballardie.)

USEFUL WEIGHTS TO KNOW—VARIOUS.

| | | | |
|----------------------------------|-----|-----|-------------|
| Average Man | ... | ... | 150 lbs. |
| A crowd per foot super | ... | ... | 84 lbs. |
| Do tightly packed per foot super | ... | ... | 120 lbs. |
| Elephant average | ... | ... | three tons. |
| Small Ox | ... | ... | five cwt. |
| Large Ox | ... | ... | nine cwt. |
| One cube of brickwork in lime | ... | ... | 105 lbs. |
| 1 cubic foot of water | ... | ... | 62·32 lbs. |

The weight of pure water is to that of sea water as 1 is to 1·026.

WOODWORK.**FLOOR STAIN FOR WOOD.**

Dissolve one and a half ounces of permanganate of potash in one gallon of boiling water, apply with a flat brush working with the grain of the wood. When quite dry apply linseed oil 2 or 3 times with a flannel and then polish with bees-wax and turpentine made into a paste.

NATIVE DISTEMPER.

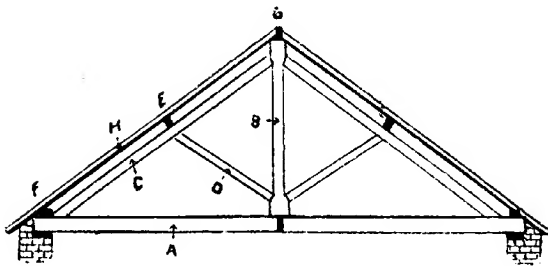
1½ bus. boiled lime, ¼ lb. glue, ¼ lb. colouring matter.

This is sufficient for a square (i.e. 100 square feet) which a mason and a cooly should be able to apply in 2 days.

STAINING WOOD.

| | |
|------------------|---|
| Mahogany colour. | Burnt Sienna ground in Vinegar. |
| Walnut do | Dissolve in hot water 1 part Soda, $1\frac{1}{2}$ parts Vandyke Brown and one 8th part Bichromate of Potash. |
| Red Stain. | Dissolve Dragon's Blood in Spirits of Wine. |
| Black Stain. | Dissolve Permanganate of Potash in water. |

WOOD ROOFS.



| | | |
|---------------|---|----------------------------|
| A. Tie beam | } | E. notched to C. |
| B. King post | | F. " to A. |
| C. Principal | | H. " to E. & F. |
| D. Street | | G. " to B |
| E. Purlin | | Trusses 10 feet apart |
| F. Pole plate | | Pitch $1\frac{1}{4}$ to 1. |
| G. Ridge | | Rafters 12' apart. |
| H. Rafter | | |

TABLE OF SCANTLINGS.

| Span. | | A. | B. | C. | D. | E. | F. | G. | |
|---------|-----|--------|--------|-------|--------|---------|---------|---------|--------|
| 15 feet | ... | 7 × 4 | 4 × 4 | 5 × 4 | None | None | 5 × 4 | 8 × 2 | 3 × 2 |
| 20 " | ... | 8 × 4 | 4½ × 4 | 5 × 4 | 4 × 3½ | 7 × 4 | 5 × 4 | 8½ × 2 | 3½ × 2 |
| 25 " | ... | 9 × 5 | 4½ × 5 | 6 × 5 | 4½ × 3 | 7½ × 4½ | 5½ × 4½ | 9 × 2 | 4 × 2½ |
| 30 " | ... | 11 × 8 | 5 × 6 | 7 × 6 | 5 × 3 | 8 × 5 | 6 × 5 | 10 × 2½ | 5 × 2½ |

SOLDERING.

For Sealing Iron in Stone : - 2 parts lead, 1 zinc.

Do Top of Canned Goods— $1\frac{1}{2}$ lb. lead, 2 lb. tin, 2 oz. bismuth. Lead to be melted first, tin added next, finally the bismuth stirred in well just before pouring. This makes a soft solder and the cans do not take much heat to open them.

Soft Solder :—1 lead, 2 tin.

For Tinned Iron : - 7 lead, 1 tin.

ONE "SQUARE."

One "square" = 100 square feet.

ROOFING FELT.

Should be perfectly dry before being coated, which should be done immediately after the felt has been laid.

Boiled coal tar mixed with well slaked lime, in the proportion of 2 gallons of the former to 5 or 6 lbs. of the latter (the lime being sifted in and well stirred after the tar has been boiled) should be applied hot with a common stiff brush or tar mop. Before the coating cools, clean dry sharp sand may be sifted over it. Or 3 buckets ordinary coal tar to 1 bucket pure wood ashes. Constantly stir over a fire and keep just under boiling point; dip a stick into it and if after wafting in the air 2 or 3 times it can be touched without soiling the fingers, then apply hot. When fit to walk over without sticking, apply coating of good substantial lime wash. Roofs for felt covering should have but little slope, if steep, the felt will drag and tear.

TILING.

| | Weight of fifty. | No. to cover a square.* |
|----------------|------------------|-------------------------|
| 13 inches long | ... lbs. 120 | ... 520 |
| 14 do | ... „ 150 | ... 468 |
| 15 do | ... „ 194 | ... 424 |
| 16 do | ... „ 237 | ... 380 |

Native Tiles.

| | | |
|----------------------|---------------------|---------|
| 13 x 5 $\frac{1}{2}$ | ... No. per ton 830 | ... 660 |
|----------------------|---------------------|---------|

Mangalore Tiles.

150 tiles = 100 square feet.
 1,000 „ = 2 $\frac{1}{2}$ tons.
 * A square = 100 square feet.

MASONRY.**DRY RUBBLE.**

| Quantities. | Rate. | Per cube of 100 feet. |
|--------------------------|----------|-----------------------|
| 100 cubic feet Stone ... | Rs. 0-10 | Rs. 10-00 |
| 3 Masons ... | " 1-25 | " 3-75 |
| 6 Coolies ... | " 0-50 | " 3-00 |
| Contingencies ... | say | " 0-75 |
| | | Rs. 17-50 |

RUBBLE IN MORTAR.

| | | |
|----------------------------|----------|-----------|
| 84 cubic feet Stone at ... | Rs. 0-10 | Rs. 8-40 |
| 20 do Lime at ... | " 0-60 | " 12-00 |
| 40 do Sand at ... | " 0-08 | " 3-20 |
| 4 Masons at ... | " 1-25 | " 5-00 |
| 8 Coolies at ... | " 0-50 | " 4-00 |
| Contingencies ... | say | " 2-00 |
| | | Rs. 34-60 |

TOOL DRESSED MASONRY.

| | | |
|-----------------------------|----------|-----------|
| Prepared stone per cube ... | ... | Rs. 30-00 |
| Lime 10 bushels at ... | Rs. 1-00 | " 10-00 |
| Sand 15 do at ... | " 0-08 | " 1-20 |
| Mason 6 days at ... | " 1-25 | " 7-50 |
| Cooly, 6 do at ... | " 0-50 | " 3-00 |
| | | Rs. 51-70 |

BRICKWORK IN LIME.

| | | |
|---------------------------|---------------------|-----------|
| 1,400 Bricks at ... | Rs. 18-00 per 1,000 | Rs. 25-20 |
| 16 cubic feet Lime at ... | " 0-60 | " 9-60 |
| 30 do Sand at ... | " 0-08 | " 2-40 |
| 5 Masons at ... | " 1-25 | " 5-75 |
| 10 Coolies at ... | " 0-50 | " 5-00 |
| Contingencies at ... | say | " 2-50 |
| | | Rs. 50-45 |

FLOORS.

Per sq. of 100 feet

Lime concrete floor 4 in. thick, 2 of sand, 1 of lime,
4 of broken stone.

| | | |
|------------------------|---------|-----------|
| Ditto, 6 inches thick. | Rs. at | Rs. 10-00 |
| 6 bushels lime ... | at 1-00 | " 6-00 |
| 8 do sand ... | at 0-08 | " 0-64 |

| | | | | | Per sq. of 100 feet. |
|--|-----|---|----|--|----------------------|
| 32 bushels metal (to pass through a 1½ in. ring) at 0.15 | Rs. | 4 | 80 | | |
| ½ Day Mason at 1.25 | ,, | 0 | 63 | | |
| 2 Coolies at 0.50 | ,, | 1 | 00 | | |
| | | | | | Rs. 23.07 |

| | | | |
|---|-----|----|----|
| Cement plastering over ditto ½ in. thick of pure cement | Rs. | 25 | 00 |
| 3 cement, 2 sand | ,, | 20 | 00 |
| 1 do 1 do | ,, | 15 | 75 |
| 1 do 2 do | ,, | 12 | 50 |

It is not recommended to lay pure cement. Sand should be mixed to let in the air. If pure cement is laid it should be mixed with water to the consistency of a paste and then rubbed in with a broom. This is technically called "grouting," and must not be done except over cement concrete.

In damp situations 6 inches of rough paving below the concrete is recommended.

| | |
|--|--------------|
| Cement concrete floor, 4 inches thick | Per square |
| 1 cement, 2 sand, 6 broken stone | of 100 feet. |
| (Without cement plaster on top) | Rs. 24.50 |
| Ditto, 6 inches thick | ,, 35.00 |
| Brick floor laid on flat at 400 bricks to a square ... | ,, 18.00 |
| Ditto ,, ,, on edge at 500 ,, ,, ,, ... | ,, 25.00 |
| Floor of clay or sand powdered | ,, 2.50 |
| Soorkie concrete floor 100 of metal, 13 lime, 13 well burnt brick dust, 13 sharp sand. Mixed dry and then water, it should be well stamped down. | |
| Asphalte flooring, say, inclusive per square ... | Rs. 35.00 |

COST OF CONSTRUCTION OF A FIRST-CLASS CART ROAD.

Width 12 feet.

5280 lines }
5,280 feet } = one mile.

| | | | | Per mile. |
|--|-----|-------|----|--------------|
| Foundation @ Rs. 23/00 a line of 100 feet | Rs. | 1,214 | 40 | |
| Metal (including carts, watering, &c.) @ Rs. 34/50 a line of 100 feet | ,, | 1,821 | 60 | |
| Cutting side drains 2' x 1½' 3 cubes @ Rs. 4/00 ... | ,, | 211 | 20 | |
| Contingencies (Superintendence) @ 10% | ,, | 324 | 72 | |
| | | | | Rs. 3,571.92 |

GENERAL INFORMATION

63

| | | | |
|---|----------|-----|-----------|
| Up-keep. —Clearing side drains | per mile | ... | Rs. 20-00 |
| Surface drainage | " | ... | " 15-00 |
| Clearing jungle on both sides | " | ... | " 10-00 |
| Metal rolling, &c., in proportion to requirements (see rate above.) | | | |

COST OF ROAD METAL.

| | | | |
|-----------------------------|-----|----------|----------------------|
| Quarrying and Sledging | ... | Rs. 0-84 | per cube of 100 feet |
| Blacksmith and boy | ... | " 0-24 | " " |
| Breaking | ... | " 3-75 | " " |
| Transport and piling | ... | " 2-00 | " " |
| Contingencies—Overseer, &c. | ... | " 0-17 | " " |
| <hr/> Rs. 7-00 | | | |

PLASTERING.

| | | | |
|---|-----|-----|----------------------|
| Plastering in lime 1 coat | ... | ... | Rs. 6-00 per square. |
| Do " 2 coats | ... | ... | " 7-50 " |
| Do " best polished | ... | ... | " 10-00 " |
| For best polishing put 3 lbs white lead to 1½ bushel boiled lime. | | | |
| This is sufficient for a square (i.e. 100 sq. ft.) | | | |

WOODEN FLOORS.

Square=100 sq. feet.

| | | | |
|--|-----|-----------|-------------|
| | | | Per square. |
| Flooring including everything but cost of timber | ... | Rs. 10-00 | |
| Do tongued and grooved | ... | " 15-00 | |

PINE WOOD FLOORING BOARDS. (In running lengths.)

| | | |
|---------------------------------------|-----|-----------|
| 6 inches wide × 1 inch thick, nominal | ... | Rs. 35-00 |
| Approximate weight per sq. 1½ cwt. | | |

PINE WOOD CEILING BOARDS. (In running lengths.)

| | | |
|---------------------------------------|-----|-----------|
| 6 inches wide × ¾ inch thick, nominal | ... | Rs. 25-00 |
| Approximate weight per sq. 100 lbs.* | | |

These prices are net, ex go-downs, Colombo.

SUNDRY WORKS.

| | | | |
|---|-----|----------|-------------------------|
| | | | Per square of 100 feet. |
| Ceiling cloth, fixed | ... | Rs. 7-50 | |
| Roofing, tiled lean-to (tiles Rs. 15 per 1,000) | ... | " 15-00 | |
| Do trussed | ... | " 17-50 | |
| Do jungle shingled lean-to | ... | " 12-00 | |
| Do do trussed (shingles Rs. 10 per 1,000) | ... | " 15-00 | |
| Do teak shingled lean-to | ... | " 33-00 | |
| Do do trussed | ... | " 36-00 | |
| Do corrugated iron lean-to | ... | " 24-00 | |

Per square of 100 feet.

| | | | | |
|--|---------|-----|-----|-----------|
| Roofing, Corrugated | trussed | ... | ... | Rs. 28'00 |
| Weather boarding, feather edged | ... | ... | ... | 6'00 |
| Trellis-work | ... | ... | ... | 7'00 |
| Factory windows, including glass, putty, &c. | ... | ... | ... | 10'00 |
| Whitewashing | do | ... | ... | 0'30 |
| Painting, 1 coat (including materials) | ... | ... | ... | 4'00 |
| Do | 2 coats | ... | ... | 6'50 |

If timber has to be bought, at say Rs. 2'50 per cubic foot,

roofing will cost :— per square.

| | | | |
|------------------------------|--------------|-----|-----------|
| Corrugated iron lean-to roof | ... | ... | Rs. 90'00 |
| Do | 15 feet span | ... | 94'00 |
| Do | 20 „ trussed | ... | 100'00 |
| Corrugated 30 feet trussed | ... | ... | 113'00 |
| Do | 40 „ do | ... | 130'00 |
| Shingle lean-to roof | ... | ... | 48'00 |
| Do | 15 feet span | ... | 53'00 |
| Do | 20 „ do | ... | 66'00 |
| Do | 30 „ do | ... | 80'00 |
| Do | 40 „ do | ... | 88'00 |

NAILS.

Nails required per 100 square feet for following works :—

| Class of work. | 1 in. | 2 in. | 2½ in. | 3 in. | Shingle Nails. | Spike Nails. |
|----------------------|-------|-------|--------|-------|----------------|--------------|
| | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. |
| Trellis-work | ... | ... | ... | ... | ... | ... |
| Louvre Boarding | ... | 1 | ... | ... | ... | ... |
| Ceiling Cloth | ... | ... | ... | ... | ... | ... |
| Weather Boarding | ... | ... | ... | ... | ... | ... |
| Tiled lean-to Roof | ... | 1½ | ... | ... | ... | 2 |
| „ trussed | ... | 1½ | ... | ... | ... | 2½ |
| Iron Roofing | ... | ... | ... | ... | ... | 2½ |
| Shingle Roofing | ... | 1½ | ... | ... | 4 | 2½ |
| Teak Shingle Roofing | ... | 1½ | ... | ... | 2½ | 2½ |
| Boarded Flooring | ... | 2 | ... | ... | ... | 1½ |

JARRAH.

A hard West Australian wood now largely used in Ceylon for building purposes, for which it is very suitable. Joists, weather boards, scantlings, floor board, etc., are stocked in Colombo by The E. P. & E. Co., Colombo Commercial Co., Ltd., and Messrs. Carson & Co., Ltd.

No fixed prices can be given at present time.

There is an impression

Among a great number of people that the word "Venesta" is synonymous with "Three-ply." This says something for its reputation but unfortunately brings with it complaints of all the unsatisfactory boards that rightly belong to someone else.

*We are not the only makers of
Plywood but we are the
— only makers of —*

VENESTA PLYWOOD

Comprised of picked veneers only, specially cemented under hydraulic pressure rendering it waterproof, unshrinkable, practically indestructible and stronger than ordinary wood twice its thickness. It is smooth and white and offers an ideal surface for either paint or polish. For bungalows, movable buildings, etc., or for inside wall or ceiling, panelling, it is the most durable and hygienic material in the world.

*We shall be pleased to mail
you a descriptive booklet and
— samples on request. —*

See p. 72.

Venesta Ltd.
1 Great Tower St. E.C.
London
England

Facing p. 64.

The leading brand in Ceylon declared the best in the market by the leading Engineers of Government and other boards.
Reduced regardless of Cost, to make room for the large shipments arriving in regular succession.

Ready mixed and ground in Oil.

Varnishes, Turpentine, Oils, Gold Paints, Gold Sizes, French Polish, Enamels, Brushes, Distempers, Paints.

Carpenters' Tools, Brass and Iron Locks, Padlocks, Nails, Hinges, Screws, &c.

American Cloth, Morocco Linen, Coach Binding, Carriage Paint, Marine, Fringes, Tassels, Hooks and Eyes, Knobs, Staples, Gig Cloth, and Pastings, &c.

Plain and Figured Rolled Glasses.

Specially light—notable feature with this style is increased length—a gain of about 30 per cent. being effected when a comparison is made with the older and usual type of bar.

Mangalore Roofing Tiles of all Descriptions.

Flat Tiles, Ridge Tiles, Flooring Tiles, Half Tiles, Ventilating Tiles, Sky Light Tiles, Glass Flat Tiles and Half Round Glass Tiles (Country Tiles Pattern) and all Descriptions of Ornamental Tiles, Glazed Floorings and Sanitary Wall Tiles, Balusters, Paper Weights, Goggles, Wall Brackets.



First Class quality only of the best texture and finish. Large in size and moderate in price.

Large Stock of
English Refined
Coal Tar
Kerosene, Gallons and
Bottles.
English Medal Glue

INSPECTION INVITED.

The most reliable and
best-paying Distemper
that a householder can use.

The first London, Warranted Water Paints, approved and Certificate of the
International Institute of Engineers.

JOSEPH & Co., 75, WOLFENDALE, COLOMBO.

SOLE AGENTS TILBUT, COLOMBO.

Telephone No. 619.

Woods.—Doon, Dawata, Keena, Madool.

Teak Sawn Shingles. 15 in × 5 in.; cost Rs. 42-50 per 1,000; 480 to square; about 2,800 to a ton.

A double-bullock cart will carry 3,000.

Angle for shingle roofs 45°.

CEYLON RAILWAY RAILS.

| Weight per Lineal Yard. | Length of Rails. | Width of Top Flange. | Width of Bottom Flange. | Height of Rail. |
|----------------------------|---------------------|-------------------------|----------------------------|--------------------|
| 46½ lb. | 20 ft. 0 in. | 2 in. | 3½ in. | 3⅞ in. |
| | 24 ft. 0 in. | | | |
| 60 lb. | 18 ft. 0 in. | 2⅞ in. | 4½ in. | 4 in. |
| | 21 ft. 0 in. | | | |
| 72 lb. | 18 ft. 0 in. | 2½ in. | 4½ in. | 4½ in. |
| | 21 ft. 0 in. | | | |
| | 24 ft. 0 in. | | | |
| 80 lb. | 30 ft. 0 in. | 2½ in. | 5 in. | 5 in. |
| | 30 ft. 0 in. | | | |
| 88 lb. | 21 ft. 0 in. | 2½ in. | 5½ in. | 4½ in. |
| | 30 ft. 0 in. | | | |

LIQUID FUEL.

Liquid fuel is the residue after the volatile petrol and ordinary kerosene have been drawn off, by distillation, from the crude mineral oil as found in its natural state. Liquid fuel can be used in the furnace of any steam boiler after certain alterations, the cost of which is given at about Rs. 250-00. The fire grate is usually covered with fire bricks and the liquid fuel is blown into the furnace, by spray injections, steam or air being used to inject the spray.

It is therefore necessary, on starting to light a fire in the furnace with coal or wood, to get up a little steam to start blowing in the liquid fuel.

The Diesel Liquid Fuel Engine was the first Engine designed to run by complete combustion on Liquid Fuel. The initial cost however is prohibitive to its general use, although many are installed in Ceylon in Power Stations and Tea Factories. Some of the largest engines in Ceylon are Diesels, which run the Colombo Tramway and Lighting at Messrs. Boustead Bros., Colombo.

Liquid Fuel is now universally used in oil engines in place of Bulk Petroleum, being far less inflammable and considerably cheaper. There are numerous depôts up country where a steady supply can be

obtained. In a Bates Engine 17 B.H.P. is developed on a consumption of one gallon of Liquid Fuel per hour, or, in other words, 1 B.H.P. for less than 1 cent per hour.

Messrs. Davidson & Co., Ltd., are agents for the most popular type of compressor in use in Ceylon. The compressors are supplied in the following sizes:—

| | | | |
|---|-----|-----|------------|
| No. 1 Vertical single acting air compressor | ... | ... | Rs. 425-00 |
| " 2 " " " " | " | ... | " 562-50 |
| " 2 Horizontal Double " | " | ... | " 1,025-00 |
| " 3 " " " " | " | ... | " 1,480-00 |
| " 4 " " " " | " | ... | " 1,890-00 |

Prices for delivery ex their Local Dépôt.

Davidson & Co. supply suitable burners, connections, tanks, &c., to special estimate and order.

Walkers supply a Liquid Fuel Apparatus for use in connection with Dryers, Boilers, etc.

The Colombo Commercial Co., Ltd., are agents for the Höveler Liquid Fuel Apparatus (British manufacture), for all types of tea and rubber driers.

The apparatus which consists of an air compressor of very simple construction with suitable air receiver, air pipes, furnace front and door, liquid fuel injector and cocks, also oil tank and supply pipes is so constructed that with little trouble either liquid or solid fuel can be used.

The air compressor is belt driven, and may be placed anywhere near the shafting where it is most convenient to obtain the power, and the air under pressure, can be conveyed to the receiver by suitable piping.

A Paragon Dryer consumes about seven gallons of liquid fuel per hour which would work out approximately .03 gallons per lb. of made tea.

A KELANI VALLEY ESTATE.

| | | | | |
|------------------------------------|-----|-----|-----|------------|
| * Cost per gallon in Colombo | ... | ... | ... | cts. 17-00 |
| Transport by rail (6th class rate) | ... | ... | ... | " 1-43 |
| To Estate, return empties, &c. | ... | ... | ... | " 1-24 |

Cost per gallon on Estate ... cts. 19-67

A layer of broken fire bricks placed at the bottom of the furnace is necessary to maintain combustion.

A 10 H.P. Engine consumes per hour 1 gallon.

" " " " 90 lbs. coke.

One gallon liquid fuel turns out 30 to 40 lbs. made tea at a cost of

| | |
|----------|-------------------------|
| for oil | 0-84 cts. per lb. |
| for coke | 0-16 " " " |
| | <hr/> 1-00 cts. per lb. |

If firewood is used instead of coke the cost would be cts. 0.09 per lb. less.

Gross weight liquid fuel 200 gallons = one ton.

Barrels tare $\frac{1}{2}$ cwt. each. Contents of a barrel average 45 gallons.

Being about 200° flash test, there are no restrictions with regard to its storage.

Cost of Oil.—Ordinary Bulk Petroleum per gallon at Colombo 72 cents, Nawalapitiya 84 cents, Hatton 84 cents, Nanuoya 87 cents, Bandarawella 90 cents. Less Government Rebate of 25 cents per gallon to be deducted in accordance with regulations.

TEA ROLLERS.

| Name. | Price in Colombo | Approx. capacity Withered Leaf. | Weight. | Size of Pulley. | Revolutions per Minute. | H. P. to Drive. |
|--|--|---------------------------------|------------|---------------------------|-------------------------|-----------------|
| JACKSON'S | | lbs. | C. qr. lb. | | | |
| "Little Giant" ... | Prices cannot be given but will be submitted on application. | 50 | 11 0 | 0 18" x 3 $\frac{1}{4}$ " | 60 | 1 |
| 24 in. "Economic" ... | | 150 | 19 0 | 0 21" x 5" | 85 | 2 |
| 24 in. "Economic" ... Brass mounted | | 150 | 20 0 | 0 21" x 5" | 85 | 2 |
| 28 in. "Economic" ... | | 250 | 38 0 | 0 21" x 5" | 100 | 3 |
| 32 in. "Economic" ... | | 300 | 40 0 | 0 24" x 5" | 100 | 3 $\frac{1}{2}$ |
| 24 in. Square "Rapid" } | | 200 | 30 3 | 0 18" x 3 $\frac{1}{4}$ " | 110 | 3 |
| 32 in. Square "Rapid" } | | 300 | 48 0 | 0 24" x 5" | 100 | 4 |
| 32 in. Square "Rapid" } | | 300 | 48 0 | 0 24" x 5" | 100 | 4 |
| New "Metallic" "Roller" } | | 330 | — | — | 100 | 4 |

(WALKER, SONS & CO., LTD.)

BROWN'S PATENT TRIPLE-ACTION TEA ROLLER.

Improved (1913) Type.

| Name. | Price in Colombo. | Capacity of Withered Leaf. | Weight. | Size of Pulley. | Revs. per Minute. | H. P. |
|--|-------------------|----------------------------|---------|-----------------|-------------------|-------|
| Brown's Patent Tea Roller, with Wood or Brass lined table. | On application. | 350-400 lbs. | 3 Tons | 24" | 120-140 Approx | 4 |

COLOMBO COMMERCIAL CO., LTD.

H. E. D'ESTERRE'S DOUBLE ACTION BATTENS.—Patent.

These battens are suitable for all tables and machines and for all classes of Tea, but will specially appeal to those whose present rolling accommodation is only just equal to their requirements, four rolls of 15 minutes replacing the usual three rolls of 30 minutes.

(THE E. P. & E. CO., LTD.)

CONSUMPTION OF WOOD FUEL.**DRYERS.**

One cubic yard lbs. 1,000 of Tea
fired lbs. of Tea. C. yards of firewood.

(The following Estates use Water power):—

| | | | | |
|---|-----|-----|-----|------|
| Estate with 4 Desiccators, output 448,000 lbs. per annum | ... | 183 | ... | 5.46 |
| Estate with 1 Sirocco, 1 Desiccator and Venetian Dryer, output 303,000 lbs. | ... | 182 | ... | 5.50 |
| Estate with 1 Britannia Dryer and 1 Desiccator, output 440,000 lbs. | ... | 270 | ... | 3.70 |
| Estate with same Dryers as above, output 215,000 lbs. | ... | 430 | ... | 2.32 |

GENERAL.

Average for engines and dryers of various types 49 cwt. or say 7 cubic yards to 1,000 lbs. of tea.

Dryers only 20 cwt. or 2½ cubic yards to 1,000 lbs. made tea.

Double Desiccator working 293 days consumed yards ... 315

Crop 302,000 lbs.

= 3½ yards to 1,000 lbs. tea.

| | | |
|--------------------------------------|----------|---------------------------|
| 72 inch Venetian... | ... | ¾ lb of wood to 1 lb. tea |
| Large "Paragon" with plenum stove... | ¾ " | " " 1 lb. tea |
| Up-draft Siroccos | ... 1½ " | " " 1 lb. tea |
| Down-draft | ... 1 " | " " 1½ lbs. tea |
| Sirocco Pressure Driers | ... 1 " | " " 1½ lbs. tea |

1 cubic yard firewood = about 560 lbs.

4 " yards " = " 1 ton

12 " " " = " 1 ton of coal for firing

1 lb. coal = 3 lbs. wood for firing

Wood varies considerably in weight—lightest 500 lbs. green wood up to 1,200 lbs. per cubic yard.

WOOD FUEL FOR TEA FACTORIES.

Best native hard woods, as used in Brick and Lime Kilns, are Gal-Mora (*Pometia excelsa*), Mora (*Nephelium Longana*).

COAL vs. WOOD.

Record of Experiment to ascertain Relative Cost of Burning Coal and Firewood in a 14 H. P. Locomotive
Marshall & Sons' Boiler. — H. K. R.

| Fuel. | Number of days experiment. | FUEL. | | MADE TEA. | | TIME. | | COST. | |
|-------|----------------------------|---------------------|---------------|------------|---------------|------------------------------------|-----------------|------------------|----------------------|
| | | Total consumed lbs. | lbs. per day. | Total lbs. | lbs. per day. | Average hours per day fire was up. | Per lb. of Tea. | Per lb. of Fuel. | |
| Wood | 34 | 69,551 | 2,046 | 21,545 | 633 | 11.00 | 6 75 | 1.06 | Per yard Rs. 1.50 |
| Coal | 20 | 13,302 | 665 | 10,125 | 506 | 10.35 | 10 27 | 2.03 | Per ton Rs. 34.60 |

WIRE SHOOT ROPES AND ACCESSORIES.

The following are the usual systems of wire rope transport : -

- (1) The Endless Running Rope, with carriers hanging therefrom and moving with it through frictional contact, the usual form of Aërial Ropeway in Ceylon.
- (2) An Endless Rope, with the carriers hanging therefrom and moving with it, being rigidly fixed in position on the rope.
- (3) The Single Fixed Rope, in which one carrier is drawn to and fro, hanging from a fixed rope, by means of an endless hauling rope.
- (4) The use of Two Fixed Ropes, with an endless hauling rope, in which one carrier travels in one direction, while the other runs on a parallel rope in the opposite direction. This is a thoroughly serviceable type of Tramway capable of being used over extremely long spans, and of carrying loads up to 5 tons.
- (5) The use of One Fixed Rope placed on an incline on which carriers, uncontrolled by hauling ropes, from which are suspended loads, are allowed to run down at a high speed. This is generally called a "shoot."

AËRIAL ROPEWAYS.

This form of transport is becoming increasingly popular in Ceylon, not only on account of its inherent advantages, but also from the fact that it liberates a large number of coolies who can be more profitably employed, and to whom the labour of transport is particularly distasteful.

The advantages of an Aërial Ropeway as against all other forms of transport may be enumerated as follows :—

Small initial cost as compared with roads and bridges.

Extreme simplicity in working.

Ability to transport materials in a direct line over precipitous ground, rivers, defiles, etc.

Small consumption of power as compared with the tonnage transportable.

Exact capacity for transport.

Small demand for labour in loading and receiving.

Aërial Ropeways are a speciality of the E. P. & E. Co. and C. C. Co. These Companies have erected many miles of ropeways and will furnish all particulars, etc., on application.

MICHIE'S WIRE SHOOT RUNNERS.

Michie's Patent Wire Shoot Runner is fitted with an enlarged axle, in the body of which a cavity for holding oil is formed. This cavity is filled with oil after the runner is placed on the rope ready to start, and the bearing surfaces draw their supply of lubricant from it during the

journey down the shoot. They are stocked in two sizes, viz. :—5 inch wheel for very easy gradients, and 3½ inch wheel for ordinary gradients. Special sizes can be made.

(WALKER SONS & Co., LLd.)

COST OF TEA FACTORIES.

A Tea Factory 100 ft. x 40 ft. with ground and three upper floors—a verandah 15 ft. wide running the full length of one side. Teak windows and frames, pine floors and cement throughout on ground floor, complete with withering Tats, erected Rs. 32,000

One all iron Tea Factory 87 ft. 6 ins. x 40 ft. 3 ins. having ground floor and two upper floors of the same dimensions a verandah 17 ft. deep along one side, a leaf entrance and porch on first floor with two stairs outside, internal partitions to form engine room, rolling room, firing room, sifting room, and office, inside stairs, to all floors. Constructed of H steel columns and cross beams, jarrah joists, pine tongued and grooved flooring on two upper floors and cement concrete ground floor, teak window and door frames and sashes, 24 W.G. galvanized corrugated sheets on roofs, sides and gables, eaves gutters 8 ft. half round section and 4 ft. down pipes, dwarf wall in brick or stone pointed with cement 3 ft. high, cement concrete foundation for all columns, internal partitions lined with lumi-midilla, all stairs of teak, erected complete, excluding transport, about Rs. 19,000.

PACKAGES.

VENESTA, LTD.

Sole Agents : (COLOMBO COMMERCIAL Co., LTD.)

The following sizes of Venestas are made and are usually to be bought in Colombo. They are supplied in lots of 100 packages complete with all necessary lead, rivets, fittings, etc.

| Patent "Venesta" Tea Packages. | Capacity | Weight Complete with 2 oz. Venesta Metal Lining. | Prices in Colombo free of rail. With Lining. |
|--|----------|--|--|
| D. PATTERN WHITE. | | | On application. |
| OUTSIDE DIMENSIONS. | lbs. | lbs. | |
| Chests 22 x 22 x 24 for Broken Pekoe or Pek. | | | |
| Sou. Leaf (D Pattern Black) ... | 110 | 18 | |
| Chests 20 x 20 x 24 for Pekoe Sou. Leaf ... | 110 | 18 | |
| Chests 19 x 19 x 24 for Pekoe Leaf ... | 110 | 17 | |
| Chests 19 x 19 x 22 for Broken Pekoe ... | 110 | 16 | |
| Half-Chests 16 x 16 x 20 ... | 80 | 12 | |

By the use of these chests about 30 % less weight of packing material has to be sent to the Estate, and 10 % more Tea is carried for about the same gross weight.

The light and even tares and the choice of sizes of Chests for different grades enable the maximum amount of Tea to be packed with the minimum management rate in London.

PATENT "VENESTA" RUBBER PACKAGES.

| Size. | Weight. | Prices in Colombo, free on Rail. |
|--------------|------------|----------------------------------|
| 21 x 21 x 24 | 16 lbs. | |
| 12 x 19 x 24 | 14 „ | |
| 24 x 24 x 12 | 13 „ 8 oz. | |

Venesta Cases of the same Internal Capacity as wooden cases measure from 10 % to 20 % less for Ocean Freight, and weight from 40 % to 60 % less, for Land Carriage, than wooden cases of the same internal over measurement.

For convenience in fitting together these Patent Packages it is advisable to have the following special appliances which cost approximately—

| | | |
|---|-----|-----------|
| Teak Bench with horn and Iron plates complete | ... | Rs. 75 00 |
| Teak Horn with bolts to affix to table | ... | „ 7 50 |
| Set of Iron Plates bored to screw on table | ... | „ 15 00 |

CHESTS.

Sizes of Packages.

| Outside Measurement. | Cubic ft. | Capacity lbs. |
|----------------------------|-----------|---------------|
| 24 in. x 19 in. x 19 in. = | 5.013 | 80—100 |
| 17 in. x 17 in. x 17 in. „ | 2.675 | 50—60 |
| 13 in. x 13 in. x 13 in. „ | 1.271 | 20 |
| 10 in. x 10 in. x 10 in. „ | 0.578 | 10 |
| 8 in. x 8 in. x 8 in. „ | 0.300 | 5 |
| 8 in. x 4½ in. x 4½ in. „ | 0.093 | 2 |
| 5 in. x 4 in. x 4 in. „ | 0.046 | 1 |
| 5½ in. x 3½ in. x 3½ in. „ | 0.039 | ½ |

COST OF BRIDGES.

PRE-WAR PRICES GIVEN FOR ROUGH GUIDANCE ONLY.

Cost of foot bridges 4 feet wide for horse or foot traffic only.

Flooring of bridge to be of timber.

Costs given are inclusive of all steelwork bolts, hand rail uprights, and hand rails only for bridge, and do not include any timber for the flooring, bolts to fix timber flooring are included.

| Bridge | 10 feet | × 4 feet | weight | 9 cwt. | price | Rs. | 108-00 |
|--------|---------|----------|--------|--------|-------|-----|----------|
| " | 20 | " | × 4 | " | 20 | " | 242-00 |
| " | 30 | " | × 4 | " | 48 | " | 540-00 |
| " | 40 | " | × 4 | " | 60 | " | 700-00 |
| " | 60 | " | × 4 | " | 85 | " | 950-00 |
| " | 80 | " | × 4 | " | 115 | " | 1,275-00 |
| " | 100 | " | × 4 | " | — | " | 1,600-00 |

up to, and including 30 ft. span, the girders of bridges would be of H section steel girders, over 30 ft. span, the girders would be lattice type.

If the foregoing bridges were made with buckle or curved plates to carry a cement floor the prices would be as follows:—

| Bridge | 10 feet | span | 4 feet | wide | ... | Rs. | 162-00 |
|--------|---------|------|--------|------|-----|-----|----------|
| " | 20 | " | " | 4 | " | " | 350-00 |
| " | 30 | " | " | 4 | " | " | 700-00 |
| " | 40 | " | " | 4 | " | " | 920-00 |
| " | 60 | " | " | 4 | " | " | 1,275-00 |
| " | 80 | " | " | 4 | " | " | 1,720-00 |
| " | 100 | " | " | 4 | " | " | 2,150-00 |

Cost of light road bridges for cart traffic with a roadway of 10 ft. wide, steelwork only for bridges with buckle or curved plates to carry a cement floor.

| Span | 10 feet | × 10 feet | wide | ... | Rs. | 330-00 |
|------|---------|-----------|------|-----|-----|----------|
| " | 20 | " | × 10 | " | " | 700-00 |
| " | 30 | " | × 10 | " | " | 1,250-00 |
| " | 40 | " | × 10 | " | " | 4,000-00 |
| " | 50 | " | × 10 | " | " | 4,550-00 |
| " | 60 | " | × 10 | " | " | 5,200-00 |
| " | 80 | " | × 10 | " | " | 7,000-00 |
| " | 100 | " | × 10 | " | " | 8,500-00 |

Cost of light "Swing" bridges 4 ft. wide used on Estates for foot traffic only. Steelwork for *termini* including cost of eye bolts for straining floor and hand rail ropes. Approximately Rs. 350-00.

Cost of flooring and hand ropes, cradles, etc. " " 2-50 per lineal ft.

PRICES OF STEEL ROAD BRIDGES.

(WALKER, SONS & CO., LTD.)

From 10 to 100 feet span having roadway 10 feet wide fitted with side rails.

GENERAL INFORMATION

75

Rolled steel joists with curved plate Bridges.

| | | | | |
|--------------|-----|-----|-----|----------|
| 10 feet span | ... | ... | Rs. | 375-00 |
| 15 " " | ... | ... | " | 725-00 |
| 20 " " | ... | ... | " | 1,050-00 |
| 25 " " | ... | ... | " | 1,350-00 |
| 30 " " | ... | ... | " | 1,700-00 |

Lattice Girder Bridges.

| | | | | |
|---------|-----|-----|---|-----------|
| 40 " " | ... | ... | " | 3,300-00 |
| 50 " " | ... | ... | " | 4,850-00 |
| 60 " " | ... | ... | " | 6,100-00 |
| 70 " " | ... | ... | " | 7,250-00 |
| 80 " " | ... | ... | " | 8,450-00 |
| 90 " " | ... | ... | " | 13,200-00 |
| 100 " " | ... | ... | " | 14,500-00 |

The above prices are approximate only. They are liable to fluctuation according to cost of materials, etc.

MASONRY RATES.

(KALUTARA.)

| | Cts. | Per | ft. |
|---|----------|-----|---------|
| Rough stone foundation with lime facing | 8 | " | " |
| WALLS 14".—Brick with lime plaster | 15 | " | " |
| Rough stone with lime | 25 | " | sq. " |
| " " with mud | 20 | " | " " |
| Cut and dressed masonry—finished with cement painting | 50 | " | cube |
| Wedged stone pointed with cement one side and lime plaster the other side | 50 | " | sq. ft. |
| Plain cut stone | 25 | " | " " |
| Plastering walls inside | 6 | " | " " |
| FLOORS AND DRAINS.— | | | |
| Cement Concrete 4" with $\frac{1}{2}$ " top dressing | 35 to 40 | " | " " |
| Wedged stone drains, cement pointed | 25 | " | " " |
| Rough stone drains | 10 to 15 | " | " " |

All cement and lime on Contractor's Account.

BUILDING AND CARPENTRY RATES.

| Rate per day. | Ambagamuwa. | Dimbulu. | Hewahetla. | Matale. | Pasara. | Maturatta. | Rangula. | Peradeniya. | Maskeliya. |
|--|-------------|------------------|------------------|----------------|------------------|------------------|-----------------|------------------|--|
| Carpentry | Ra. 1-00 | Ra. 1-00-1-25 | Ra. 1-00-1-25 | Cts. 75- 50 | Ra. 1-00-1-50 | Ra. 1-00-1-25 | Cts. 80-1-00 | Ra. 1-00 | Ra. 4-50-100 sq. feet |
| Masonry | 1-00 | 1-25 | 1-00-1-25 | 75-1-00 | 1-00-1-50 | 1-00-1-25 | — | 1-00 | 55 cts. cub. foot 20" sq. feet paving |
| Estate wages— | Cts. | Cts. | Cts. | Cts. | Cts. | Cts. | Cts. | Cts. | Cts. |
| (a) Men | 35-40 | 30-40 | 33-37 | 35 | 35-40 | 33-37 | 33-40 | 40 | 38-50 |
| (b) Women | 25-28 | 25 | 25-27 | 28 | 25-30 | 25-28 | 25-50 | 25-30 | 26 |
| Sawing timber on Estate per 100 ft. ... | — | — | Ra. 5-00-6-50 | — | Ra. 5-00-7-00 | Ra. 5-00-6-00 | — | Ra. 7-00-9-00 | Ra. 7-50 |
| Firewood, cutting per yard without (trans- port) | — | — | Cts. 30-35 | 30 | Cts. 25-35 | Cts. 20-30 | — | Cts. 25 | Cts. 34 |
| Transport per ton mile | — | 50-75 | — | 50 | 60-1-00 | 43-70 | 65 | 70 | — |

Building and Carpentry Rates—(KALUTARA)—Contd.

| | | | | | |
|--------------------------------|-----|-----|----------|-----|-----|
| CARPENTRY.—On unplanned timber | ... | ... | 5 | Per | ft. |
| On planned timber | ... | ... | 6 | " | " |
| Lunumedella Ceiling Boards | ... | ... | 14 to 16 | " | " |
| Jak or Teak doors and Window | ... | ... | 75 | " | " |
| Glazed " " " | ... | ... | 60 | " | " |
| Sawing | ... | ... | 5 to 6 | " | " |

Firewood Cutting.

Per yard 25 to 30 cts.

Estate Wages.

| | | | | |
|------------|-----|-------|-----|-----------------|
| Tamils | ... | Men | ... | 36 to 40 cents. |
| " | ... | Women | ... | 25 to 30 " |
| Singhalese | ... | Men | ... | 45 to 60 " |
| " | ... | Women | ... | 25 to 30 " |

PELMADULLA.

| | | | |
|---------------------|-----|-----|----------------------|
| Carpentry | ... | ... | Rs. 1-00 to Rs. 1-50 |
| Masonry | ... | ... | " 1-00 to " 1-50 |
| Sawing Timber | ... | ... | " 4-00 to " 8-00 |
| Firewood | ... | ... | Cts. 20 |
| Local Wages— | | | |
| 1. Sinhalese men | ... | ... | Cts. 50 to Cts. 60 |
| 2. " women | ... | ... | " 30 to " 33 |
| 3. Tamil men | ... | ... | " 35 to " 40 |
| 4. " women | ... | ... | " 25 to " 30 |
| Transport— | | | |
| By Bullock | ... | ... | Cts. 75 to Cts. 80 |

RAKWANA.

| | | | |
|---------------------|-----|-----|----------------------|
| Carpentry | ... | ... | Rs. 1-00 to Rs. 1-25 |
| Masonry | ... | ... | " 1-00 to " 1-25 |
| Sawing Timber | ... | ... | " 5-00 |
| Firewood | ... | ... | Cts. 40 |
| Local Wages— | | | |
| Tamil men | ... | ... | Cts. 33 to 40 |
| " women | ... | ... | " 25 |
| Transport— | | | |
| By Bullock | ... | ... | " 75 |

BALANGODA.

| | | | |
|---------------------|-----|-----|-----------------------------|
| Carpentry | ... | ... | Cts. 75 to Rs. 1-25 |
| Masonry | ... | ... | " 12 to Cts. 50 per ft. |
| Sawing Timber | ... | ... | Rs. 5 to Rs. 10 per 100 ft. |
| Firewood | ... | ... | Cts. 35 to Cts. 40 |
| Local Wages— | | | |
| Tamil men | ... | ... | Cts. 35 to Cts. 50 |
| " women | ... | ... | " 25 to " 30 |
| Transport— | | | |
| By Bullock | ... | ... | Cts. 75 |

RATNAPURA.

| | | | |
|------------------|-----|-----|----------------------|
| Carpentry | ... | ... | Rs. 1-25 to Rs. 1-50 |
| Masonry | ... | ... | see note |
| Sawing Timber | ... | ... | see note |
| Firewood | ... | ... | Cts. 35 to Cts. 40 |
| Local Wages— | | | |
| 1. Sinhalese men | ... | „ | 60 to „ 75 |
| 2. „ women | ... | „ | 30 to „ 40 |
| 3. Tamil men | ... | „ | 35 to „ 40 |
| 4. „ women | ... | „ | 25 to „ 35 |
| Transport— | | | |
| 1. By Bullock | ... | „ | 80 to Rs. 1-00 |

Note—

| | | |
|--------------------------|--------------------------------------|--|
| Masonry. | Dry Rubble | Rs. 15-00 to Rs. 20-00 per cube of 100 ft. |
| | Rubble and mortar | Rs. 30-00 to Rs. 40-00 per 100 ft. |
| | Tool dressed stone masonry | Rs. 40-00 to Rs. 50-00 per cube of 100 ft. |
| | Tool dressed stone masonry in mortar | Rs. 55-00 to Rs. 80-00 per cube of 100 ft. |
| | Brickwork in mortar | Rs. 50-00 per cube of 100 ft. |
| | Culverts split stone hammer dressed | Rs. 25-00 to Rs. 30-00 per 100 ft. |
| Sawing Timber on Estate. | | Rs. 8-50 to Rs. 9-00 for Jak, Milla and other hard woods, and Rs. 7-00 to Rs. 7-50 for soft wood, per 100 sq. ft. (Ceylon sawyers' measurement.) |

TRANSPORT.

| | | | |
|--------------------------|-----|-----|-----------|
| Per Ton per mile by Cart | ... | ... | 50 cents. |
| „ „ „ Boat | ... | ... | 10 „ |

COST OF RUNNING A 2 TYPE HALLEY'S MOTOR LORRY FOR 1 WEEK
ON THE DELTOTA ROAD, GALAHA.

Standing Charges for 1 Week.

| | | | |
|--|-----|-----|------------------|
| Driver and cooly | ... | ... | Rs. 35-00 |
| Insurance and Garage | ... | ... | „ 7-60 |
| Interest on Capital at 8% (Rs. 9500/-) | ... | ... | „ 14-61 |
| Depreciation on vehicle less Tyres @ 25% | ... | ... | „ 43-60 |
| | | | <hr/> Rs. 100-21 |

Running Charges per Week of 328 Miles.

| | | | |
|--|-------|-----|-----------------|
| Petrol 35.5 Gallons @ 1/35 less rebate | ... | ... | Rs. 47-92 |
| Oil and Grease | ... | ... | „ 2-00 |
| Repairs and Renewals | ... | ... | „ 14-00 |
| Tyres | ... | ... | „ 32-80 |
| | | | <hr/> Rs. 96-72 |
| | | | „ 100-20 |
| -60 per mile | | | |
| -30 „ Ton mile | Total | ... | Rs. 106-92 |

GENERAL INFORMATION

Friday, 16th January.

Left Factory at 9 a.m.
 Arrived Galaha 10:5
 Left Galaha 10:20
 Arrived Peradeniya 11:32
 Load : 34 Chests (1 ton 17 cwt. 3 qr.)
 4 up
 Left Peradeniya 3 p.m.
 Arrived Loolecondera 5:45 p.m.
 Load : 27 Bags Rice
 10 Tins Petrol (fuel)
 4 up

Total Mileage

52 Miles

Weather : Fine

Saturday, 17th January.

Left Garage empty at 7:50
 Arrived for Firewood at 8:10
 Left for Galaha at 8:35
 Load : 1½ tons firewood (4 yards)
 Arrived at Galaha at 9:20
 Left Galaha 10:15
 Load : 36 Chests (38 cwt.)
 Arrived Station 11:25
 Left Station 12:50
 Arrived Loolecondera 3:50
 (20 minutes' stop for Motor Bike)
 Load : 28 Bags Rice
 3 up

Total Mileage

45 Miles

Weather :

Wet Morning

Fine Afternoon

Monday, 19th January.

Left Garage at 8 a.m.
 Loaded up firewood from 8:15 to 8:50 (5 yards)
 Arrived Galaha at 9:30
 Left Galaha at 10:15
 Load : 40 Chests (1 ton 17 cwt.)
 Arrived Peradeniya 11:45
 Left Peradeniya 1:45
 Arrived Garage 4:10
 Load : 27 Bags Rice
 ½ cwt. Potatoes
 3 up

Total Mileage

45 Miles

Weather :

Wet Morning

Fine Afternoon

RUTHERFORD'S PLANTERS' NOTE BOOK

EXTRACTS FROM THE RULES OF THE CONVEYANCE OF GOODS
ON CEYLON GOVERNMENT RAILWAY.

Packing for Tea, Rubber, and Desiccated Coconuts. Lead, hoop iron, nails, shocks, and other articles used for tea packing or for the packing of tea, rubber, or desiccated coconuts which are entered in the Goods Classification for conveyance at sixth class rates, if certified as such, will be accepted for conveyance by rail in consignments of from 1 to 4 tons at sixth class rates.

Unhooped Tea Chests.—Wooden tea chests containing more than 60 lbs. of tea, which are not bound or hooped with iron, are accepted and conveyed at owner's risk only.

Timber Unwrought.—Including beams and rough planks sawn, but not planed or adzed, of such sizes as to admit of 3 tons being loaded in any ordinary wagon will, if sent in consignments of not less than 3 tons, be charged fifth class rate on actual weight, but if of less than 3 tons the freight will be charged at fourth class on actual weight, or at fifth class on 3 tons, whichever is the lesser amount.

† **Bulky or heavy Articles.**—(a) When two or more wagons are required for the conveyance of boilers, engines, girders, machinery, shafts, masts, logs, beams, and such articles as from their great length or weight cannot be carried in one ordinary wagon, the minimum charge will be as for two tons per wagon for first, second, third, and fourth class goods, 3 tons per wagon for fifth class goods, and 4 tons per wagon for sixth class goods; but should the freight, if calculated on 2 tons per wagon at third or fourth class rate, amount to less than for 3 tons per wagon fifth class goods, or 4 tons per wagon for sixth class goods, the lower charge will be made.

(b) All bulky or heavy articles under this clause are conveyed at owner's risk, and the owners must provide the necessary tackle and labour to load and unload them, but the use of railway fixed cranes will be granted free up to the lifting capacity of the crane.

* (c) The usual loading and unloading charge of 25 cents per ton will be deducted from freight on such goods.

(d) All articles measuring more than 14 ft. in length, 7 ft. in breadth, or 7 ft. in height, will be charged as "bulky articles."

Small or Loose Articles.—If Coconuts, Arcanuts, Bones, Bottles, Shells, Chunks Earthenware, Shingles, Staves, or other small articles are forwarded loose, a minimum charge will be made of 25 cents per wagon per mile over the Main Line below Nawalapitiya, and over the Matale, Kurunegala and Coast Line Branches, and 50 cents per wagon per mile over the Main Line above Nawalapitiya plus the usual loading

and unloading charge of 25 cents per ton on the weight of the contents; and if delivery is not taken within the time allowed free after arrival, demurrage will be charged. If the freight calculated on actual weight amounts to more than the minimum the higher charge will be made.

Plants, Straws, Cadjans, Empties, and Packages of a Light or Frail Nature.—Tea baskets excepted, requiring special accommodation, i.e. goods of which less than 2 tons occupy a whole wagon, will be liable to a minimum charge of 25 cents per wagon per mile over the Main Line below Nawalapitiya, and over the Matale, Kurunegala, and Coast Line Branches, and 50 cents per wagon per mile over the Main Line above Nawalapitiya; and if delivery is not taken within the time allowed free after arrival, demurrage will be charged. Tea and rubber baskets will be subject to half the minimum charge laid down for other packages, viz., a minimum of $12\frac{1}{2}$ cents per truck per mile below Nawalapitiya and 25 cents per truck per mile above Nawalapitiya.

Goods of the Sixth Class—in quantities less than 4 tons, to be charged as 4 tons, or at Third Class rate on actual weight, whichever is lower.

Various.—Single and separate parcels under 56 lbs. in weight will be accepted as Goods, and charged as for 56 lbs.

The fractional part of half a cwt. of Goods will be reckoned as half a cwt.

The minimum charge for a consignment of Goods is 25 cents.

When not specially provided, the minimum distance on which a mileage charge will be made is 10 miles.

The minimum charge for a Cattle truck will be Rs. 5.

Weights.—The Government do not hold themselves bound by any weights inserted by consignors or their consignment notes, as freight charges are calculated on the weights obtained, when necessary, by weighing on the weighing machines of the Railway Department; nor do they admit any responsibility in respect of the weights thus arrived at either as basis of claim for shortage or as regards their absolute correctness as between buyer and seller. The weights taken on the railway weighing machines are merely for the purpose of determining the amount of the freight charges.

If the owner of Goods conveyed by railway should doubt the weight on which the freight charges have been based, the Goods will be re-weighed on payment of the re-weighing charge of 25 cents per ton. If the difference is found to be 28 lbs. or more per ton, the charge made for re-weighing will be refunded and the freight charges rectified. If the difference is less than 28 lbs. per ton, original weight on railway invoice will be considered correct.

CLASSIFICATION OF RAILWAY GOODS.

(Rates are exclusive of loading and unloading charges.)

GOODS CONVEYED BY SPECIAL AGREEMENT ONLY.**Dangerous Petroleum Oil.**

FIRST-CLASS RATES.—24 cents per ton per mile Coast Line, Negombo Line and Northern Line, 37½ cents per ton per mile Main Line below Nawalapitiya and also on the Kurunegala and Matale Branches, 46½ cents per ton per mile Main Line above Nawalapitiya.

SECOND CLASS RATES.—16 cents per ton per mile Coast Line, Negombo Line and Northern Line, 25 cents per ton per mile Main Line below Nawalapitiya and also on the Kurunegala and Matale Branches, 31 cents per ton per mile Main Line above Nawalapitiya.

THIRD-CLASS RATES.—12½ cents per ton per mile Coast Line, Negombo Line and Northern Line, 17 cents per ton per mile Main Line below Nawalapitiya and also on the Kurunegala and Matale Branches, 25 cents per ton per mile Main Line above Nawalapitiya.*

FOURTH-CLASS RATES.—12½ cents per ton per mile Coast Line, Negombo Line and Northern Line, 12½ cents per ton per mile Main Line below Nawalapitiya and also on the Kurunegala and Matale Branches, 20 cents per ton per mile Main Line above Nawalapitiya.†

FIFTH-CLASS RATES.—10 cents per ton per mile Coast Line, Negombo Line and Northern Line, 10 cents per ton per mile Main Line below Nawalapitiya and also on the Kurunegala and Matale Branches, 20 cents per ton per mile Main Line above Nawalapitiya.

SIXTH-CLASS RATES.—Minimum, 4 tons. (For exception see clause 35) 8 cents per ton per mile Coast Line, Negombo Line and Northern Line, 8 cents per ton per mile Main Line below Nawalapitiya and also on the Kurunegala and Matale Branches, 16 cents per ton per mile Main Line above Nawalapitiya,‡

FREIGHT FOR BOMBAY.

The price of freight for Bombay for tea is Rs. 10 per 50 cubic feet.

NOTES.—Passenger trains will take precedence of Goods Trains. No strangers will be allowed to be about the Railway Goods Shed, &c., except on business. No load must be higher than 13 feet 6 inches at the highest point in the centre of the wagon from the level of the rails and must be gradually rounded off at each side; and no load must project more than 6 inches over the side of the wagon.

* Rice is conveyed over the Main Line at the same rate above as below Nawalapitiya.

† Tea ditto.

‡ Tea packing and manure ditto.

E. B. CREASY & Co.

— 12, BAILEY STREET, COLOMBO. —

JEYES' DISINFECTANTS.

— FLUID, POWDER, SOAPS. —

A preventive of Rinderpest and Foot-and-mouth disease.

FOR BUNGALOWS AND COOLIE LINES.

REX FLINTKOTE ROOFING—

Supersedes all "Patent" Roofings—Can be laid over rotting shingles and to reduce the heat of Corrugated Roofing. In three thicknesses for various purposes. Rot-proof, water-proof and cheaper than any roofing of similar quality.

VAPORITE—

For eradicating insects in the soil of nurseries, gardens, vegetable beds, &c., &c.

SOLIGNUM—

The preservative of timber against the attacks of white ants, in three shades of brown, and green. Takes the place of paint and beautifies the wood bringing out the grain.

E. B. CREASY & Co.

12, BAILLIE STREET, COLOMBO.

ESTATE REQUISITES
OF ALL DESCRIPTIONS.

Momi Boxes,

Tea Lead,

Hoop Iron,

Nails,

Jute Hessian.

Barbed Wire—

Galvanised Corrugated Roofing.

Galvanised Water Piping.

THE LONDON & COLOMBO

Forwarding Agency.

(E. B. CREASY & Co.), COLOMBO.

Will deliver tea free in United Kingdom
at following rates:—

LONDON DISTRICT
OTHER PARTS

1 lb. 10 lbs. 25 lbs. 50 lbs. 100 lbs.

During War all rates withdrawn.
Conditions on application.

Very Extra. Special Rates for Large Quantities.

STEAMER FREIGHTS.

There is a loss of 11 per cent. in freight by shipping in half and quarter chests, and 20 per cent. in shipping chests containing packet teas,

| | | |
|-----------------|-----|-------------------------------|
| Example | ... | 2,000 lbs. in bulk and chests |
| Do. | ... | 2,000 „ packets in chests |
| 90 lb. Chests:— | ... | Packet Teas:— |
| 111 cubic feet | ... | 133 cubic feet |
| 2·22 tons | ... | 2·66 tons |

LONDON SALES.

London sales of Ceylon Teas average 34 to 36 days after date of shipment in normal times.

FOREIGN PARCEL AGENCY RATES.**London and Colombo Forwarding Agency.**

(ESTABLISHED 30 YEARS.)

For forwarding tea from Colombo to any address in the United Kingdom. (Payable at either end.)

| | | | | | | | |
|---------------------|----------|------|-------|-------|-------|-------|-------|
| Nett lbs. | 5 | 10 | 20 | 40 | 50 | 90 | 100 |
| Charges | Rs. 2·25 | 4·50 | 7·00 | 11·00 | 12·00 | 17·50 | 21·00 |
| Duty 5d. at ex. 1/4 | Rs. 1·55 | 3·10 | 6·20 | 12·40 | 15·50 | 27·90 | 31·00 |
| | Rs. 3·80 | 7·60 | 13·20 | 23·40 | 27·50 | 45·40 | 52·00 |

NOTE.—These rates are for nett weight of tea. A 5 lb. box of tea weighs about 8½ to 9 lbs. gross, parcels post is on gross weight.

Insurance to £5 value free. Rupees and cents for duty vary with exchange.

PARCEL POST SYSTEM.**BETWEEN CEYLON AND THE UNITED KINGDOM.**

Parcels are received at all Post Offices in Ceylon for transmission by post to the United Kingdom, and to other countries via London.

Charges.—The postage charges to the United Kingdom are:—

By British Parcel Post Service (parcels not exceeding 11 lbs. in weight)

| | | |
|--------------------------------|-----|----------|
| For the first 3 lbs. | ... | Rs. 0-75 |
| Above 3 lbs. and up to 7 lbs. | ... | „ 1-50 |
| Above 7 lbs. and up to 11 lbs. | ... | „ 2-25 |

By P. & O. Company's service (parcels *above* 11 lbs. and not exceeding 50 lbs. in weight)—50 cents. per lb.

ENGLISH INLAND PARCEL POST TARIFF.

| | | |
|-------------------------------|-----|--------------------------------|
| Not exceeding 1 lb. gross 3d. | ... | Not exceeding 8 lbs. gross 8d. |
| Do 2 „ „ 4d. | ... | do 9 „ „ 9d. |
| Do 3 „ „ 5d. | ... | do 10 „ „ 10d. |
| Do 5 „ „ 6d. | .. | do 11 „ „ 11d. |
| Do 7 „ „ 7d. | | |



TEA.

TEA SEED.

The selection of the class of seed suitable for a given climate and locality is of great importance. For an estate of rich soil in a forcing climate with abundant rainfall, the finest jât will naturally be the most suitable, but when these conditions are only partially fulfilled a plant of comparatively robust habit will be necessary according to circumstances.

It would be a good method for estates to rear a plot of high class tea specially as a seed garden. This is usually a patch by itself in the recesses of a forest. This tea is never pruned, but is cultivated whilst being allowed to grow in its natural shape and to its natural height. Under these conditions the plant yields a large crop of seed, and being absolutely isolated from any other plot of tea and secure from hybridization, the jât of seed produced may be depended on. "Seed bearers" are subject to blights, so care should be taken to keep all blights and diseases away. Seed from a healthy tree produces a healthy plant.

Another method for securing seed is by picking seed from selected healthy pruned bushes; by this system only a few seeds can be obtained from each bush; but as with fruit trees when the quantity of fruit is restricted by pruning, the quality is proportionately improved; so in this case the small quantity of seed obtained is robust, full and healthy, and its germination can be depended on.

A few trees along boundaries and ravines could be left unpruned as "seed bearers."

The tea flower appears any time from July to October, about fourteen months elapse before the seed is ripe.

The seed of indigenous is generally larger than that of hybrid or China jâts. When the seed is ripe the capsule assumes a dark green or a purple tinge, after which it begins to dry and shrink, which causes it to burst and the seed falls to the ground. These are the best seed if picked up immediately. If the seeds are picked off the trees, the greatest caution is necessary that the seed is ripe before being picked, as the seed on the bush does not all ripen at the same time.

Un-opened capsules should be laid out in the sun for half an hour daily until most of them have split.

Shelled seeds should on no account be exposed to the sun.

TO DRY.

Spread the seed out two or three inches deep on the floor of any cool airy house or verandah. If the seed is to be kept for a length of time, it may be kept covered over with dry mould, dry charcoal dust, or in sand. Seeds of high class plants are more delicate and lose vitality more rapidly than hybrids. In keeping the seed it is of the utmost importance to note that immediately after being gathered, it has a great tendency to ferment if kept in a close condition. Until ready for packing or planting the seed must be kept spread out.

TESTING SEED.

Testing seed to ascertain the percentage of good is not so simple as is generally supposed. The ordinary way is to count out 100 seeds and then crack them all, examining them one by one; this is not an accurate test. The best way would be to take a few from each maund or package, count 300 and plant them out in lots of 100 and take the percentage from the plants grown. To throw a handful into a pail of water as some planters do is by no means a correct test.

Germinating beds or nurseries should be ready for seed before it comes to hand. The sooner it is out the better, as tea seed loses its vitality rapidly.

GERMINATING SEED.

Germinating beds may be made by clearing and digging a piece of ground thoroughly to a depth of a foot or more, level off, cover over with six inches of manure (cattle—best), cover again with four inches of light pulverized soil on the top of which the seed may be spread, not touching; cover over with two inches of fine sifted soil or sand, water abundantly, every second or third day or if in cold cloudy weather once or twice a week or ten days. If the climate is cold glass frames may be necessary in order to generate sufficient heat.

SEED AT STAKE.

A favourite method is to plant out with germinated seed "at stake." The seeds are taken very carefully out of the bed and placed in a small vessel containing liquid manure (cattle dung mixed with a little white ant earth and water—best); and each cooly takes his own lot to the land which has previously been prepared, lined and staked, with holes made at the stakes where the plants are to grow. In one of these holes the cooly carefully places one or more seeds in such a way, that when he fills up the hole with loose soil, the seed will be about two inches from the surface. He then shades it with bracken fern to keep it from drying up. It should be noted that the finger-like shoot which first comes from a seed on germination is not the stem but the root, and in planting germinated seed this must be put downmost.

PACKING SEED.

The best mode of packing tea seed for transport is with dry charcoal dust, perhaps a little well dried earth mixed. The seed must be packed in layers with sheets of strong paper between to keep the charcoal dust from getting to the bottom of the chest. If seed has to be taken a very long distance or for any reason cannot be sown for some months, it must be packed in tinlined cases and hermetically sealed. In this way it has been known to keep its vitality for several months. Seeds germinate in about a month and they should be picked out daily. The higher the jât the thinner the shell, and therefore the quicker the germination.

Empty seeds (without kernel) should be picked out, intelligent coolies soon detect these with their eye, test in the hand, and pick out. A cooly can pick 6 to 15 lbs. of seed according to season, cost per maund picking; husking and packing in bags Rs. 3 to Rs. 4. 7 maunds with capsules give 4 maunds clear seed. The quantity of seed required for planting a new clearing depends upon the system to be adopted in planting.

NURSERIES.

The number of seed in a maund (82 lbs.) varies greatly, and may be from 12,000 to 25,000 or even more if of poor jât. In ordinary circumstances it is safe to expect about 10,000 plants from a maund of really good high class tea.

The following table shows the area which can be planted with one maund of seed if the lining is rectangular. With triangular planting (See Manual Section) about 15 per cent. must be deducted from the area in each case.

TABLE SHEWING SIZE OF NURSERY REQUIRED FOR SEED AT VARIOUS DISTANCES.

| Distance apart of Seed in inches. | Area in square inches per Seed. | Area required per maund of Seed including paths. | Size of nursery for every 10 maunds. |
|-----------------------------------|---------------------------------|--|--------------------------------------|
| 4 in. x 4 in. | 16 inches | 4,000 sq. ft. | 400 ft. x 100 ft. |
| 4 in. x 3 in. | 12 " | 3,000 " | 300 ft. x 100 ft. |
| 4 in. x 2 in. | 8 " | 2,000 " | 200 ft. x 100 ft. |
| 3 in. x 3 in. | 9 " | 2,250 " | 225 ft. x 100 ft. |
| 3 in. x 2 in. | 6 " | 1,500 " | 150 ft. x 100 ft. |
| 2 in. x 2 in. | 4 " | 1,000 " | 100 ft. x 100 ft. |

| Feet apart. | Plants per Acre. | Acres per Maund of Seed. |
|-------------|------------------|--------------------------|
| 3½" x 4" | 3,111 | 3 |
| 4" x 4" | 2,722 | 3½ |
| 4½" x 4" | 2,420 | 4 |
| 5" x 4" | 2,178 | 4½ |

These figures are on the assumption that the nurseries are successful and the planting out equally so.

50 per cent. extra seed is required for supplying. In all nurseries here come up a certain proportion of bad jât or of sickly plants. These must not be used for planting out, and as soon as they are fairly distinguished they should be uprooted and thrown away as weeds.

Imported seed 1 maund equal to 10,000 plants

Local fresh 1 " " 15,000 do

1,000 plants banded for transport = 66 lbs.

In selecting land for nurseries the very best soil is required. Old nurseries should not on any account be used for this purpose again. Low-lying swamp land is unsuitable for a nursery.

The land should be thoroughly cleared, all roots grubbed out and carried off. It must then be dug all over to a depth of two feet; all sticks, stones and rubbish being brought to the surface and carried off. It should be gone over a second time, all lumps broken up and the soil thoroughly pulverized, and all twigs, etc., sifted out.

Beds should be laid out $4\frac{1}{2}$ feet wide with passages 2 feet wide between. Where the soil is light the beds should not be raised higher than three or four inches. The seed may be sown $4'' \times 4''$ which is a good workable distance even when the transplanting machine is to be used. An excellent implement for sowing with consists of a board $4\frac{1}{2}' \times 12'$ drilled with holes in three lines four inches apart. This is laid across the bed; a cooly stands at each bed with round sticks for boring the ground, and they can together bore and sow with wonderful rapidity. The seeds should be sown one to two inches below the ground. In watering nurseries care should be taken to see that it is done thoroughly, the soil should be soaked; then no more watering until it has become moderately dry again.

Seeds require the warmth of the sun as well as the influence of the moisture in order to germinate. A very common custom is to cover the beds with grass immediately after sowing, in order to keep in the moisture. This is very good if the situation is very hot and dry; if water cannot be had for watering the beds it is absolutely necessary to cover them, but in ordinary circumstances it is a hindrance rather than a help, as it hinders the action of the sun upon the ground.

Nurseries should be frequently weeded by hand.

R. G.

(The writer of the above is indebted to *Indian Tea*—Claud Bald, **TRACKER SPIKE & Co.**, Calcutta, for a number of his facts.)

COST OF WORKS PER ACRE.

Planting 4 ft. \times 3½ ft. = 3,000 plants to an acre.

| | Low-country | | Average Elevation. | |
|--|-------------|-------|--------------------|-------|
| | From | To | From | To |
| | Rs. | Rs. | Rs. | Rs. |
| Felling and Clearing— | | | | |
| Heavy Mukulana jungle, per acre | 15-00 | 20-00 | 20-00 | 25-00 |
| Medium jungle „ | 10-00 | 15-00 | 15-00 | 20-00 |
| Chena ... „ | 6-00 | 8-00 | 7-00 | 10-00 |
| Lining— | | | | |
| (Including pegs) ... „ | 4-50 | 5-00 | 3-00 | 3-50 |
| Holing— | | | | |
| Size of hole 16' deep, 9" in circumference at top and 5" at bottom @ 75 holes per cooly = 40 coolies „ | — | — | — | — |
| Cost : Tamils, per cooly „ @ 40 cts. 16-00 | — | — | — | — |
| „ „ „ „ @ 38 cts. — | — | — | 15-20 | — |
| „ Sinhalese, per cooly „ @ 50 cts. 20-00 | — | — | 20-00 | — |
| Filling in— | | | | |
| @ 200 holes per cooly = 15 coolies „ | — | — | — | — |
| Cost : Tamils, per cooly „ @ 40 cts. 6-00 | — | — | — | — |
| „ „ „ „ @ 38 cts. — | — | — | 5-70 | — |
| „ Sinhalese, per cooly „ @ 50 cts. 7-50 | — | — | 7-50 | — |
| Roading— | | | | |
| Say 2½ chains per acre—Labour including side drains @ 25 ft. per cooly 6 ft. in the solid = 6½ coolies „ | — | — | — | — |
| Cost : Tamils, per cooly „ @ 40 cts. 2-60 | — | — | — | — |
| „ „ „ „ @ 38 cts. — | — | — | 2-47 | — |
| „ Sinhalese, per cooly „ @ 50 cts. 3-25 | — | — | 3-25 | — |
| 2 Irish drains per acre, say 60 sq. ft. in all „ @ 05 cts. 3-00 | — | — | — | — |
| „ „ „ „ @ 04 cts. — | — | — | 2-40 | — |
| Extra for blasting rocks according to condition of land often up to „ | 5-00 | — | 3-00 | — |
| Cost of drilling and blasting per foot | 0-12 | 0-15 | 0-30 | 0-40 |

| | | Low-country. | Average Elevation. |
|--|-------------|--------------|-----------------------|
| Draining— | | | |
| 16" x 16" @ 35 ft. apart = 1,244 | | Ra. | Ra. |
| Lin. feet. | | — | — |
| Earth cutting @ 01 ct. per ft. | | | |
| or say, 40 ft. per cooly | | — | — |
| Cost : Tamils, per cooly = | @ 40 cts. | 12-40 | — |
| " " " | @ 38 cts. | — | 11-78 |
| " Sinhaless per cooly = | @ 50 cts. | 15-50 | 15-50 |
| Blasting and drilling rocks up to say (according to condition of land) per acre. | | 5-00 | 5-00 |
| Planting— | | | |
| With stumps 300 per cooly = 10 coolies | | — | — |
| Cost : Tamils, per cooly | " @ 40 cts. | 4-00 | — |
| " " " | " @ 38 cts. | — | 3-80 |
| " Sinhaless, per cooly | " @ 50 cts. | 5-00 | 5-00 |
| With basket plants or trans-plan- ters, 150 plants per cooly = 20 coolies | | — | — |
| Cost : Tamils, per cooly | " @ 40 cts. | 8-00 | — |
| " " " | " @ 38 cts. | — | 7-60 |
| " Sinhaless, per cooly | " @ 50 cts. | 10-00 | 10-00 |
| Supplying— | | | |
| Same as above, according to the percentage of vacancies | | — | — |
| Shading— | | | |
| 250 plants per cooly = 12 coolies | | — | — |
| Cost : Tamils, per cooly | " @ 40 cts. | 4-80 | — |
| " " " | " @ 38 cts. | — | 4-56 |
| " Sinhaless, per cooly | " @ 50 cts. | 6-00 | 6-00 |
| Fern, say 5 cts. a bundle for 200 bundles | | 10-00 | 10-00 |
| Weeding— | | | |
| 1st year | " per month | 2-00 | 3-00 |
| 2nd year | " " | 1-50 | 2-00 |
| 3rd year and afterwards | " " | 1-25 | 1-50 |

| | | Low country. | Average Elevation. |
|--|----------------|-----------------|-----------------------|
| | | Rs. | Rs. |
| Shade Trees— | | | |
| Planted 20' x 10,' say 200 trees | | — | — |
| Say holing and planting | per acre | 5.00 | 5.75 |
| Pollarding Shade Trees— | | | |
| Per round (6-8 ft. from the ground) | | | |
| say | " | 0.50 | 0.50 |
| Centering— | | | |
| @ 8" from the ground, 500 trees | | | |
| per cooly = 6 coolies | " @ 40 cts. | 2.40 | |
| " " " " | " @ 38 cts. | — | 2.28 |
| Pruning— | | | |
| 1st pruning 350 trees per cooly | | | |
| = 9 coolies | " @ 40 cts. | 3.60 | 3.60 |
| Subsequent pruning at 200 trees to 300 | | | |
| per cooly = | " @ 5.00 to | 6.00 | — |
| " " " " | " @ 38 cts. | — | — |
| Burying Pruning— | | | |
| 2 cwts. Slag and $\frac{1}{2}$ cwt. Potash | | 10.00 | to 12.00 |
| Labour only | | 6.00 | 8.00 |
| Manure— | | | |
| Cost about Rs. 150.00 per ton. Transport according to locality of estate. | | | |
| Application, say | per acre | 4.00 to 6.60 | 4.00 to 6.00 |
| Plucking— | | | |
| @ 1½ cents per lb. green leaf | | 0.06 (made tea) | 0.06 |
| 20 lbs. leaf per cooly = 5 lbs. made tea | | — | — |
| Add for kanganies, baskets, &c. | | 1.00 | 10% |
| Manufacture— | | | |
| For average crop of 500—600 lbs. per acre | | | |
| Cooly labour and teamaker, say | (per lb.) cts. | 1.25 | 1.10 |
| Packing— | | | |
| Materials and nailing @ 10 cts. a chest, say (per lb.) | " | 2.25 | 2.00 |
| War extra | | 3 to 3½ cts. | per lb. |
| Fuel— | | | |
| According to local supplies, say | | 1.25 | 1.25 |
| Transport— | | | |
| Say average 30 miles transport by cart | | 0.50 | 0.75 |
| River transport considerably less | | 0.40 | 0.5 |

| | Low- country. | Average. Elevation. |
|--------------------------|------------------|------------------------|
| Factory Sundries— | Rs. | Ra. |
| Say | 0-10 | 0-20 |

Cost of Tea Plants—

Per 1,000 = Rs. 30-00 to Rs. 25-00 ex-nursery.

Lines—

| | | |
|--|-----------------|--------|
| Temporary cadjan, mud walls, a room | 15-00 | 20-00 |
| Permanent iron lines, a room | 120-00 | 160-00 |
| „ brick pillars, tiled roof, a room according to timber available | 65-00 to 100-00 | 1-00 |

Cost of Tiles—

| | | | |
|----------------|------------|---------------|--------------|
| Less transport | per 1,000, | 8-50 to 10-00 | 7-50 to 9-00 |
|----------------|------------|---------------|--------------|

Cost of Bricks—

| | | |
|---------------------------|-----------------|-------|
| Per 1,000, less transport | 15-00 to 18-00 | — |
| Cabook bricks | 60-00 to 100-00 | 25-00 |
| Ridging tiles, per 100 | 10-00 | 15-00 |

Transport by Padda Boat—

| | |
|-------------------------------|---------------------------------|
| One boat load = 18 to 20 tons | (180 chests @ 155 lbs. each, or |
| „ „ = 8,000 bricks | 50 candies copra or 250 cwts.) |
| „ „ = 600 bushels rice | |

Transport by Cart—

| | |
|---------------------------------------|-----------------|
| Double bullock cart load = 1 ton | (20 tea chests) |
| Half cart = $\frac{1}{2}$ ton | (10 „ „) |
| Average distance a boat travels a day | |
| 6 miles down and 3 miles up. | |
| Average distance a cart travels a day | |
| 12 miles. | |

Price of Cadjans—

| | Rs. | Ra. |
|-------------------------------|--------------|------|
| Per 100 according to locality | 1-50 to 4-00 | 3-00 |

Slaked Lime—

| | |
|--|---------------|
| Per ton for Low-country at Ambalangola. | 24-00 per ton |
|--|---------------|

DRAINS.

| Distance apart. Feet. | | Linear Feet Per Acre. | | Low-country. Cost per Acre. | Average Elevation. Cost per Acre. |
|--------------------------|-----|--------------------------|-----|-----------------------------------|--|
| 30 | ... | 1,452 | ... | 15.12 | 13.70 |
| 35 | ... | 1,244 | ... | 13.02 | 11.76 |
| 40 | ... | 1,080 | ... | 11.34 | 10.25 |
| 45 | ... | 968 | ... | 10.08 | 9.15 |
| 50 | ... | 871 | ... | 9.11 | 8.25 |
| 55 | ... | 792 | ... | 8.31 | 7.50 |
| 60 | ... | 726 | ... | 7.56 | 6.85 |
| 65 | ... | 670 | ... | 7.01 | 6.35 |
| 70 | ... | 622 | ... | 6.51 | 5.90 |

Cost is worked out on the basis of a cooly cutting 40 feet; and the check roll average being 42 cents for low-country and 38 cents average elevation. This is for surface acreage only, a proportionate addition must be made on steep lands.

PRIZE ESSAY ON TEA PRUNING.*

BY M. L. WILKINS.

The subject of pruning and connected cultivation is a particularly comprehensive one, in view of the great variety of conditions present; narrowness of ideas on such a broad subject are utterly inadmissible, and it is quite impossible to lay down hard and fast rules. One can only indicate the various conditions, species of plant, and recognised systems, giving, as far as possible, reasons for recommending their adaptability to the prevailing circumstances. Their successful application will, of course, depend on judgment and discretion. While deprecating narrowness, the other extreme—wide generalisation—must also be avoided, as an essay would then be so vague as to be valueless.

REASON FOR PRUNING.

When the branches of the tea plant reach a certain stage of development, it ceases to flush, and its functional activity becomes impaired. The sap passages are partially obstructed with deposits. The wood then matures, and, in the ordinary course of Nature, produces seed; the tree becomes unproductive, from a planter's point of view, and the operation of pruning—or the removal of the extra foliage and over-matured wood—is then necessary to maintain the bush in a leaf-producing, though unnatural, or rather artificial, condition.

TIME OF PRUNING.

Where the jāt of the bush is inferior, and the soil unfertile, this operation has to be conducted about once in 12 to 14 months; but at higher elevations, with richer soil, or where systematic cultivation is carried out, it will only be necessary to prune in 2 to 3 years—more

* Prize essay selected by a P. A. Sub-Committee.

usually two. Three-yearly or even four-yearly pruning is only possible at the highest elevations—growth being slow, and the soil generally above the average of planting districts.

CONDITIONS.

Before commencing this work the following are some of the chief conditions which should be taken carefully into consideration:—(1) Condition of wood and height of bush; (2) fertility of soil and the size of bush it should carry; (3) whether sap is ascendant or dormant; (4) weather prevailing [and] expected; (5) period of year with regard to abnormal flushes; (6) market conditions, etc.

REMARKS ON CONDITIONS.

A few remarks re these conditions may be advisable:—

1. When the bush has attained a considerable height, and more especially when the wood is in a hide-bound or gnarled condition, and thus preventing, or at least hindering, the free flow of sap, there is hardly any other course left than to "cut down"—a system so often abused, but more especially so in after-treatment. If, however, the period of the year is chosen and subsequent plucking and pruning be carefully conducted, there is no reason why unfavourable results should be anticipated. The year's yield may be reduced, but this is often made up in the following season; and, given a good system of cultivation, the severe treatment will not be required by the trees for another 10 or 15 years.

2. *Plucking Surface*—The plucking surface of the bush should be regulated to the ability of the soil to carry same. Nothing is gained beyond mere appearance of "cover" by preserving a large frame of bush when the soil is in an impoverished state; and, under these circumstances, a compact flushing surface is much more likely to yield well, produce a minimum of bangy (consequently more tip in the made tea), and be less liable to the attack of blights.

3. *Sap*.—During certain periods nitrifying micro-organisms are abnormally active, and, assisted by climatic influences, plant-food, previously unavailable, is assimilated; and a vigorous ascent of sap, which is stored in the stems, etc., is the result. To prune at this stage (the condition is indicated by profuse bleeding from recently-cut branches) is obviously inadvisable, as all such reserve material would be lost.

4. *Weather*.—Periods of severe drought should also be studiously avoided, more especially where the cutting is heavy. Light rainfall months, or when an ordinary amount of sunshine prevails, are most suitable. Pruning should also be abstained from immediately before windy months—more especially exposed fields—as the "primaries" would suffer, and the growth of young shoots be seriously hindered.

5. *Programme.*—Every effort should be made to have a large proportion of the acreage to be pruned within the year out of bearing during the heavy-flushing months, so as to be able to concentrate the labour force on the smallest area possible, keep the flush in hand, and avoid a congested state of affairs in the factory.

6. *Market Condition.*—This area should come into bearing and yield at its best when the market is recovering from over-supply, and when it is, as a rule, difficult to find work for the pluckers.

SYSTEMS OF PRUNING.

For all practical purposes, it will not be necessary to describe more than 4 methods, which will nearly always meet every requirement, and will certainly do so with a little judicious modification, viz:—(1) Topping; (2) ordinary pruning; (3) cutting across; (4) cutting down, including "collar pruning."

Topping.—Topping refers to, practically, the first real pruning the young bush receives (excepting, of course, the cutting across at about 9 inches, which is usually performed when the plant is about 1 month old). This is usually done at about 14" to 18"; the bush being simply slashed across at that level, little or no thinning-out being necessary.

Ordinary Pruning.—By ordinary pruning is meant the yearly or two-yearly operation when the new wood is cut across at a level of about 2" over the old cut. Under ordinary circumstances, with medium to poor jāt, it is advisable to thin out and remove all "scrappy" wood known as "nassambu," but every effort should be made to leave as many leaves as possible, as they may be well described as the "lungs of the plant"—their being carefully left tends to assist the bush to recover.

Advisability of Removing Unhealthy Branches.—Certain modifications can be made with regard to the extent of this thinning-out which will be referred to later. A certain number of branches will be found to be ill-nourished, crooked, and clearly inactive from, probably, some functional defect, or insufficiency or unsuitability of food: they can be of no value as leaf-producers and should undoubtedly be removed. If the tree is in a fairly vigorous condition, a new stem of clean straight wood usually replaces such branch—a most desirable result. The practice, systematically carried out, will delay the need for a severe cut down.

Cutting Across.—Cutting across is usually conducted on the same principle and at the same height as ordinary pruning, with the difference that absolutely no thinning-out is done. This system is only advisable on good jāt bushes growing under really vigorous conditions. If attempted on poor exhausted soil, or with inferior jāt bushes, the effect will, almost invariably, be unsatisfactory—an early and plentiful flush of rather a

weakly nature, for only a few months, when the trees suddenly cease flushing, being the usual result. The system is often advantageous to young and unformed bushes whose roots are being developed to support larger frames; or the best indigenous, which is very free from "nassambu; or good serviceable jāt growing on really fertile soil and under forcing climatic conditions - the growth being, in this case, so vigorous that the sap is fully employed in the stronger and straighter stems: the weaker shoots and twigs then die back. Another useful and important feature of this style of pruning lies in the fact that, by adopting it on fields which are apt to run out (and thus upset the annual pruning programme), they may continue to flush till a more convenient date for the ordinary operation. It is also useful when labour is temporarily very scarce, as this work is then apt to drift behind and upset the season's yield. The cost is usually from Rs. 2.75 to Rs. 3.50 per acre on tea which would cost from Rs. 6.00 to Rs. 7.00 for the ordinary work. Women can do this work (at a slightly extra cost) which is an advantage when sufficient men are unavailable. It is open to question if this style of pruning could be carried out continuously, as, however vigorous the bush may be, sooner or later a knot will in all probability, be formed, or a disease affect some branches. No thinning-out being done, these defects would not be noticed or rectified; and, consequently, the future leaf-producing ability of the tree, or at least the affected branches, would become impaired. It is, therefore, advisable where cutting across is adopted, to occasionally vary the system with the ordinary pruning previously described, or at least modify it by removing the defective branches and knots above mentioned.

Cutting Down and Collar Pruning.—*Cutting Down*: This severe treatment is almost absolutely necessary at certain distant periods in order to completely renew the wood. It should not be resorted to unless it is impossible to prune higher with any hope of remunerative results; and, if adopted, only a limited area should be taken in hand each year as the tea produced by bushes thus treated is, almost invariably, of a very inferior quality. If a large proportion of the estate was cut down, it is quite probable that the quality would so deteriorate as to affect the market reputation of the mark materially.—*Collar Pruning*: A high Indian authority (Sir Gen. Watt) advocates "collar pruning" (i.e. sawing the main stem across a little below the surface of the ground) in preference to the above, which is usually done at a height of from 6" to 12." This seemingly drastic treatment is rare in Ceylon.

This severe form of pruning might be required, followed by the burning of the branches, to eradicate some formidable pest, but otherwise it can only be employed as a last resource to wholly renew a

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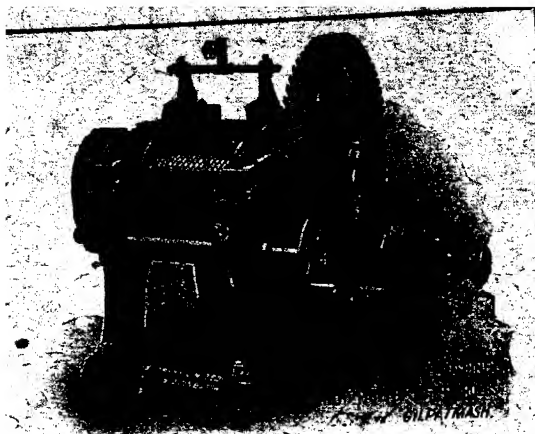
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hopelessly bark-bound and gnarled frame. But, in any case, the application of a liberal dose of manure, a little before pruning, is highly advisable to assist in the formation of an entirely new bush. Its diseased condition calling for this drastic treatment, is almost invariably an indication of a want of plant-food; and, therefore, without cultivation, the successful re-building of a new frame can hardly be expected.

JATS OF CEYLON TEA.

Jats and Their Treatment.—Jâts of Ceylon tea may be classified, for the purposes of this essay, into three kinds, viz.:—Assam-indigenous of which there are several varieties), Medium Hybrid, and China or China-hybrid. Other conditions being equal, a slightly altered method of treatment will be necessary for the same jât on fertile or impoverished soil. For instance, in the case of a medium Hybrid, thinning-out would be most advisable where a sufficiency of plant-food is not present, while, given an abundance of fertilizing substance, cutting across would answer all purposes, for a season or two, and yield a quicker return.

China Jât.—China Jât bushes have such a strong tendency to run to seed that thinning-out, and the consequent reduction of the number of eyes, is advisable under any circumstances.

Indigenous.—Indigenous must always be treated much more respectfully—on poor soil these bushes are decidedly delicate. This jât will yield at a much greater height than the two former types, as it would seem to have a much better system of sap circulation, and cutting down is only necessary at much greater intervals. In many cases the bush is so free of “nasambu” as to require little or no thinning-out. The difference in treatment in rich or poor soil is also much less than any other jât. A slightly lower, and somewhat more compact bush, on the poorer soil would be advisable, so that the tree would not demand more food than was available. These bushes cannot stand heavy pruning during the hot weather (while the lower jât would not suffer appreciably), and its delicate nature is unquestionable; therefore careful treatment is essential.

Other Jâts.—There are, of course, intermediate jâts or hybrids, but space does not permit of their being dealt with, and their resemblance to those above referred to is so close, that only a slightly altered treatment will be found necessary.

PROGRAMME.

The first item of importance is to regulate the annual area as evenly as possible, and thus avoid a widely-fluctuating yearly yield with a varying quality of leaf. Where the whole estate has to be pruned every season, as is the case on some low-country properties, this matter is simple; but it is by no means the same at an elevation of 3,000 to 4,000

feet especially where there is a variety of jāt. Systematic cultivation will tend to greatly alleviate this difficulty, as medium jāt bushes, which ordinarily run only 18 months, will, by this means, easily flush for another six and thus allow of a very simple half-the-estate-per-year-programme being carried out. The cutting-across system, previously referred to, is also helpful here, as by its use a field may be made to bear an extra few months till a more convenient date for ordinary pruning.

PRUNING HEIGHT.

With regard to the pruning height of each bush, it is almost impossible to cut all at the same distance from the ground, and every tree should be treated on its individual merits. Careful training of the pruning force, and efficient supervision is required to get the cooly to do this satisfactorily. But this is about the full extent the intelligence of the cooly can be taxed. Any further attempt at developing his discretionary powers is nearly certain to be an expensive business: he is a decidedly mechanical worker and will pass from tree to tree with absolutely no mental effort. A complexity of orders, or anything beyond certain simple rules, bewilders him; if he is at all in doubt the time lost in the attempt at thought usually means a considerably reduced daily task.

TREATMENT OF SMALL BUSHES.

Where there are a large number of small or younger plants, or supplies, requiring different treatment and after-plucking, the author has found it much the best practice to have them pruned by a special gang six weeks or two months before the rest of the field, so that, when the whole cover is ready for tipping, the supplies have grown to such a height and possess sufficiently mature wood to be safe from over-plucking, which is, in practice, so difficult to prevent, when an uneven cover is tipped together.

OBJECTIONS TO LEAVING SMALL BUSHES UNPRUNED.

If the ordinary practice—of leaving the small bushes unpruned—is followed, the results will not be as satisfactory. They often run to seed when the jāt is bad, rarely improve in wood, and frequently act as a pest or blight nursery.

DEPRECATING EXPENSIVE WORK FOR EFFECT.

Amongst the systems of pruning described, no place has been given to a style of highly ornamental work which was more commonly seen a few years ago when the margin of profit was greater than at present. Bushes thus treated, with an almost mathematically correct level, and well-clipped hedge-like appearance, however pleasing to the eye, never seem to yield any better than where a more practical but less ornamental,

system prevails; and the actual cost of this style of work is from 20% to 30% more. It is easy enough to get this work done, if the coolies are properly supervised, but the effect of constant checking is to cause each cut to be a conscious act. The cooly will lose a lot of time in trimming and clipping and finally cutting each branch to the exact level, the daily task is consequently considerably reduced. The foregoing remarks apply to mere level and the necessarily expensive trimming to attain effect. While deprecating useless expenditure on this system, it must not be thought that the writer is advocating a "cheap and nasty" or slovenly class of work, but a difference of $\frac{1}{2}$ " to $1\frac{1}{2}$ " in the level of, say, 10% of the branches cut is surely not going to affect the resulting yield materially? Expense should not be grudged in regard to the removal of knots and diseased wood, or in any matter affecting the full efficiency of the functions of the bush.

KNIVES.

Sharp knives should always be employed, and when their temper has become impaired, a water-stone, or sand-sharpening may be allowed, but this should be strictly prohibited with new knives. Inferior or blunt knives will reduce the daily task quite 10% and their use is by no means consistent with strict economy. Furthermore, a clean cut is far less harmful than a jagged one.

DIRECTION OF CUT.

The direction of the cut should always be outward from the centre, as straighter primary shoots usually spring from branches thus cut, the danger of splitting is less, outward growth is promoted, and over-crowding in the middle of the bush is reduced.

USE OF SAW AND TAR.

When cutting down, the saw should be used for all heavy branches, as the risk of splitting, if the cut with a knife is attempted, is very great. Split branches usually die back, the water getting into the stem causing decay; if a main stem, the life of the bush is endangered. Sawn branches should be tarred and the sawn face should be shaved with a sharp knife so as to present a smooth surface for the water to run off. A sloping cut is very necessary; as, if level, the bark, as it rises to cover the wounded surface, forms a rim, or cup, for water to lodge within. A vegetable tar is usually recommended, but coal tar has been found satisfactory if it is put on very carefully and not split on young shoots.

MOSS AND LICHEN.

Moss should also be carefully removed, taking care to injure the bark as little as possible, as its presence on the stem tends to smother eyes, and interfere with the growths of new shoots. It is most noticeable that,

on really healthy trees on well-cultivated soil, this trouble is conspicuously absent. The same remarks apply to blights—grey blight, red spider, and other mite pests.

WANT OF VITALITY PREDISPOSING DISEASE.

When in a weakly condition, the tree, like the human frame, seems liable to prevailing afflictions, while the healthy body or plant appears to have the power or vitality to combat such attack.

TRAILING SIDE-BRANCHES USELESS.

Trailing side-branches should also be removed; they can be of no possible use to the bush, and usually run to seed.

DAILY TASK.

At the commencement of the seasons for pruning—more especially if the labour force have done none of this work for some time—a difficulty is often experienced regarding both the quantity and quality of the daily task—the subject of a great deal of undesirable friction. The quality of the work done is the first thing to aim at, and it is advisable to let the men off with a reduced task till they thoroughly understand the style of pruning expected of them, and their blistered hands have become hardened; the number of trees per day can then be gradually increased till the full task is secured; after this a few extra trees will soon make up for the original leniency—the coolly being particularly susceptible to the give-and-take system.

PRUNING FOLLOWING A CUT-DOWN.

The first pruning after a cut-down deserves special mention. The object of cutting down, as stated previously, is to secure new wood, or to renew the frame of the bush and get rid of unhealthy stems; this being so, it is obvious that none of the four systems of pruning named would be suitable under the circumstances. A good length (say, from 6 in. to 10 in.) of the new red wood secured must be carefully left, and this is best done by cutting the tree across at its widest part; thinning it out may or may not be necessary according to the jāt and soil, as has previously been remarked. It is obvious that, if the new wood was 'cut two inches above the old cut,' as in the ordinary operation, the second pruning would be nearly as severe as the first, and the free flow of sap up the new stem, so much to be desired, would be interfered with; moreover, when it again became necessary to cut down (from 6 to 14 years afterwards), it would be most difficult to do so in the midst of a mass of knots from a succession of prunings—but this would not be the case if a good length of straight new wood was left.

"UMBRELLA" PRUNING.

A precaution, which the writer observed was adopted in the Matala Valley when pruning during the hottest weather, is worthy of mention. One or two of the main or centre stems were left unpruned until the balance of the bush was well in flush, when it was cut out. The advocates of this system assert that, in practice, a fewer number of deaths occurred than when no branch was left.

PLUCKING.

OBJECT.

The object to aim at is to secure the maximum quantity of the best possible quality of leaf, and a sufficiency of good wood to prune on when next this operation is necessary, with the least injury to the bush.

ORNAMENTAL TIPPING.

Tipping to a very accurate level, like pruning, is more ornamental than practical. Given careful after-treatment in both cases, bushes thus plucked, as compared with trees whose shoots were taken irrespective of level, will certainly shew no improvement in yield, and even the difference in appearance six months after pruning will be hardly noticeable.

NUMBER OF LEAVES TO BE LEFT.

The matter of after-treatment requires considerable care and judgment. The number of leaves to be left on the primary shoots varies with the jāt and vigour of the bush, style of pruning, climate, etc. Two leaves will be sufficient on bad jāt or vigorous bushes, while three would be a more advisable number to leave on trees on impoverished soil or delicate jāt, and four or five on tea which has been cut down.

"WHOLE LEAF" SYSTEMS.

The writer prefers the whole leaf on all good jāt bushes. But, whatever system is adopted, a full leaf should be left on all secondary and following shoots for a period of at least 8 to 10 months after pruning. All immature shoots should be carefully left, as, should they be plucked, the health and yield of the bushes will be adversely affected. After this stage, it is impossible to lay down any hard and fast rule. But an occasional few rounds to the fish or half leaf, careful plucking of bangy in its earliest stage of growth, regular plucking rounds, and careful and discreet treatment generally, the best results will be attained.

PLUCKING BAD JĀT.

The lower China jāts require distinctly hard plucking. Lenient plucking usually results in the bushes running to seed.

MANURING.

IMPORTANT CONNECTION WITH PRUNING.

Manuring has an extremely important connection with pruning. Stunted or diseased bushes are almost always traceable to defective or insufficient food-supply which acts as a predisposing condition of disease — judicious pruning may alleviate, or partially remedy, this, perhaps only temporarily, but intelligent cultivation, based on the best available scientific knowledge, combined with good practical pruning, will assuredly contribute to more permanent and effective results.

GENERAL REMARKS.

The period of application in relation to pruning is the chief subject to be dealt with in this essay. As to the general advisability of manuring any tea which shows a decline of yield, or the necessity of such for the maintenance of the health of the bushes which have cropped heavily for a considerable period, surely no arguments are required at this period of enlightenment?

SYSTEMATIC CULTIVATION ADVANTAGEOUS.

The author has had abundant opportunities of watching the effects of a system of cultivation sound both in theory and in practice, extended over some thousand or more acres for a period of from 15 to 20 years, and all tea thus consistently treated has invariably improved in health, vigour, yield, immunity from pests and quality of produce. His own personal experience, over some thousands of acres for 18 years, is identical.

BEST STAGE FOR APPLICATION.

The best stage to apply manure will be found, if the whole subject is carefully weighed, to be about 4 to 8 months after pruning. Manure, experience proves, takes at least from 3 to 4 months to become assimilated and available as plant-food, and heavy flushing may be looked for after the 5th month.

APPLICATION SIX MONTHS AFTER PRUNING ADVISABLE.

Should its application and pruning be conducted simultaneously, or a little before, the manure would tell at the same period; as the bush would, under ordinary circumstances, be yielding heavily some of its worst quality of leaf. The effect would certainly commence at a time when it was not urgently required by the plant, or desired by the planter. Furthermore, if the application took the form of large holes, both the bush and the roots would receive disturbance at the same time, while there can be no objection to the operations, both above and below the ground, being performed at different periods.

Later application, as compared with earlier manuring, has the distinct advantage of sustaining the bush more at a time when artificial aid is most necessary to support a partially-exhausted tree, and to prevent it from "running out" (or ceasing to flush) before its proper time for pruning.

APPLICATION BEFORE PRUNING ADVISABLE WHEN "COLLAR PRUNING" IS DONE.

The above remarks apply, of course, to manuring carried out with a view to maintain the health and vigour of the trees; in the exceptional case of a "cut down" or "collar prune," the object of cultivation is more to assist the tree to recover from the severity of the operation and to build up a healthy new frame: this being so, the best period for application would, doubtless, be a few months before pruning, or as soon after as possible.

AVOIDANCE OF ILL-BALANCED MIXTURES.

To recommend manures is not a subject to be dealt with in this essay, but a word of warning to avoid all ill balanced mixtures will not be out of place. Reliable analyses go to shew that a yield of 1,000 lbs. tea per acre (over, say, two years) has, at a reasonable estimate, deprived the soil of about 45 lbs. of Nitrogen, 22 lbs. Potash, 8 lbs. Phosphoric Acid, and 2½ lbs. of Lime per acre. To apply a mixture wholly deficient in any of these constituents is surely opposed to the principles of intelligent agriculture. The danger of the lack of one ingredient in an available form may render the other essential ones, though abundantly present, ineffective; and, if Nitrogen only were applied, the increased growth would remove a large amount of mineral matter which will leave the soil in a more exhausted condition than if no manure was applied at all. The steady accumulation of plant-food and improvement in health, vigour, and yield of the bush—the proper object of the cultivator—will not be attained. To apply manures not possessed of the requirements of the plant is only to court a diseased condition of the tree, and to increase the liability of the attack of prevailing pests.

IMPORTANCE OF EFFICIENT DRAINAGE.

In order to derive full benefit from cultivation, the question of the efficiency of the drains should be carefully considered. A great loss by wash and percolation must occur on steep land in rainy districts where the drains are few and far between, as is so often the case on old coffee estates. The whole area should be carefully re-drained before the application of expensive manure, if the best results are to be expected.

BURYING OF PRUNINGS.

ANGER OF FUNGOID PESTS.

Sir George Watt is the most formidable opponent of this being done, on the grounds of the liability of the attack of fungoid parasites or pests; and wherever there is any indication of the existence of these pests the burying of prunings should most certainly be avoided. But though their presence in India (where conditions are different) may be undoubted, we have no signs, as yet, of their dangerous prevalence in Ceylon. *Rosellinia radiciperda*, with its typical *mycelium*, has been discovered in various districts; but, so long as it is confined to individual patches or limited areas, burying would seem highly advisable.

SUPPLYING PLANT-FOOD BY BURYING.

We have evidence which goes to show that, at a fair estimate, about 100 lbs. Nitrogen, 70 lbs. Potash, 20 lbs. Phosphoric Acid, and 100 lbs. Lime are contained in the prunings of an acre of well-developed bushes. Assuming that only half of these constituents are lost to the soil, the cost of replacing same artificially would not be less than Rs. 60 to Rs. 70 per acre.

The writer has had opportunities of watching an area of some thousand acres thus treated systematically for a period of from 15 to 18 years, without any sign of the attack of the much-feared pests.

LIME OR BASIC SLAG A PERMANENT BENEFIT.

The danger of the appearance of these pests would, doubtless, be greatly increased when the prunings are buried without Lime or Slag, or where enormous holes or trenches with a prodigious quantity of green matter is interred. But, if the prunings are well distributed (and the greater the distribution the more aeration), say a hole to every other tree in alternate rows, and a dose of from 2 to 3 cwt. Basic Slag and 50 lbs. of Sulphate of potash per acre be applied, well dusted over the prunings, the permanent benefit to the soil, and restoration of plant-food cannot, for a moment, be doubted.

METHOD OF BURYING.

Holes 2' x 2' in the alternate rows, for every second or third tree, will be found, in practice, a most convenient mode of distribution, more especially if systematic cultivation is carried out, as manure forked in after all the green matter has become decomposed, and the hole filled with feeding roots, will doubtless be more effective—a matrix for the manure being also available, and an increased field for the nitrifying organisms to work in.

REASON FOR USING SLAG.

The reason for applying the Slag is to neutralize acids, etc., assist decomposition which will, in due course, supply organic matter rich in Nitrogen. By its application, the risk of the attack of pests are minimised. (See Chapter on Manuring.)

TEA NURSERIES.

| | | | |
|---|-----|----------|-------------------------------|
| 1 maund equals | ... | ... | 82 lbs. |
| 1 " " | ... | ... | 30,000 seed |
| 10,000 plants should be obtained from Indian seed = $3\frac{1}{2}$ acres land | | | |
| 15,000 " " | " " | Ceylon " | = 5 acres land |
| 1 bed 20 ft. x $4\frac{1}{2}$ ft. equals | ... | ... | 90 sq. feet |
| 4,000 sq. feet is required for one maund of seed planted | | | |
| 4 in x 4 in. including paths. | | | |
| 43,560 sq. feet equals | ... | ... | 1 acre |
| 10 maunds seed requires | ... | ... | 1 " |
| 1 bed with seed planted 4 in. x 4 in. takes approximately 650 seed. | | | |
| 25 beds (20 ft. x $4\frac{1}{2}$ ft.) takes 1 maund of germinated seed. | | | |
| 250 beds including paths will take | | | 1 acre. |
| 1 bed requires | ... | ... | 3 bundles fern (coolly loads) |
| 1 " " | ... | ... | 10 gallons water. |

**COST OF MAKING ONE ACRE (=10 MAUNDS SEED) TEA NURSERY AND
UPKEEP FOR NINE MONTHS.**

| | Rs. | cts. |
|---|-----|--------|
| Felling and clearing | ... | 20 00 |
| Fencing (cost of wire and erection) | ... | 35 00 |
| Making 250 beds at 2 coolies per bed | ... | 250 00 |
| Draining | ... | 4 00 |
| Roading | ... | 3 00 |
| Transporting seed (10 maunds) | ... | 5 00 |
| Germinating, picking and putting out seed (20 cts. per bed) | 50 | 00 |
| Cutting, transporting, and shading with ferns (50 cts. per bed) | ... | 125 00 |
| Hut for watchman | ... | 10 00 |
| Watering 30 beds per cooly a day for three months | ... | 360 00 |
| Watchman for 6 months @ Rs. 15-00 per month | ... | 90 00 |
| Weeding (6 months @ Rs. 8-00 per month) | ... | 48 00 |

Total Rs. 1,000 00

AVERAGE—100-00 per maund of tea seed.

AVERAGE COMPOSITION OF CEYLON TEA.

(Bamber.)

| | | | | | |
|-------------|-----|-------|-----------|-----|--------|
| Moisture... | ... | 3.50% | Insoluble | ... | 54.00% |
| Total Ash | ... | 5.50% | Theine | ... | 3.80% |
| Extract | ... | | | ... | 41.09% |

TEA SIFTING FOR THE LONDON MARKET.

One estate. Plucking medium fine. Yield 600 lbs. per acre. Heavily manured and closely plucked tea.

Percentage of small bulk 60%—small, black, broken, } very
few tips } hard

Percentage of large bulk 40%—wiry, small in size } rolled

Brown Rae sifter—long trays—thin wire meshes Nos. 8, 14 and 40.

TEA SIFTING.

Small Bulk.—This should be divided into two classes—(1) What comes out from under roll breaker sieve after sifting 1st and 2nd rolls; (2) what comes through after sifting 3rd and 4th rollings and the 5th if five rollings are adopted, as is very often the case on medium elevation estates. Small bulk from bottom of sieve after 1st and 2nd rollings pass through No. 10 sieve = B. O. P., removing dust by a No. 30. Small bulk from 3rd, 4th (and 5th) rolls, sifted in the same way = B. P. (same size, more flaky, less tip). remove dust by a No. 30. If roll breaker is in order there should be very little leaf above the No. 10 in both cases. This can be sifted again, separately or with large bulk.

Large Bulk—Above No. 8 partially break or cut. What does not then go through No. 8 is Pekoe Souchong. What goes through No. 8 treat as follows:—

Sift on machine sifter with Nos. 8, 10, 14 and 30. As stated before, above 8 is Pekoe Souchong (after breaking); above 10 is Pekoe, above 14 can either be put with Pekoe or broken on a 14 (what goes through to B. P. and what remains above to Pekoe), above the 30 is B. P., below the 30 is dust. Percentage should then work out:—

| | | | |
|-------------------------------|-----|-----|-------------|
| B. O. P. | ... | ... | 26% |
| B. P. | ... | ... | 30% |
| O. P. | ... | ... | 16% |
| Pekoe | ... | ... | 20% |
| Pekoe Souchong | ... | ... | 4% |
| Dust, &c., or Dust & Fannings | ... | ... | 4% |
| | | | <u>100%</u> |

This is assuming good leaf is plucked on medium elevation estate on 7 to 9 day rounds; rolling 5 times, pressure on last 3 rollings.

Note.—A cooly will sift 100 lbs. a day.

GREEN TEA MANUFACTURE.

Warm the steamer by turning on full steam for a short time, then place sufficient *freshly gathered* leaf in the machine to reach up to (but not over) the pipe nozzles, and, with 40 lbs. steam indicated on the boiler gauge, steam for 2 minutes, the cylinder to be turned during the process. With a lower steam pressure than that specified, it will take a little longer. If the leaf is well steamed, it will be firm but pliable; if over-steamed, it will be squashy looking. It may be advisable at first to open the cylinder and examine the leaf after the first minute to determine if it is sufficiently pliable for rolling, and a little practice will enable this to be regulated to a nicety.

It is very important to *cool* the leaf *immediately* after steaming, if not cooled within a few seconds the leaf will become over-steamed and squashy looking, and will turn into nothing but lumps during the process of rolling and firing as well as give a very cloudy liquor. The cylinder should not be turned slowly during steaming, otherwise the leaf will be unevenly steamed.

Carry the leaf to the roller when sufficient has been steamed for a fill (meanwhile letting it drain itself of superfluous moisture caused by the condensing steam). If you are using a Jackson's Rapid Roller put the roller weight firmly down for 2 minutes without setting the machine in motion. Throw away all the water that is produced by this pressure.

Roll about 10 minutes without weight, and continue to throw away the water coming from the leaf. Then roll 10 minutes with a very light pressure. Roll a further 5 minutes without weight of any sort.

Put this semi-rolled leaf on to a Sirocco—temperature about 220°—and pass the trays in and out pretty smartly, *turning the leaf as the trays come out* and breaking up *wet lumps*. As soon as the leaf begins to turn an olive green and to feel gummy, with the very slightest touch of crispness in it, put it aside to cool, until another roll has gone through the same process. From these two rolls thus partially fired there will be rather more than sufficient for a roll.

Roll now for appearance, lightly, for about half an hour, and with only sufficient pressure to ensure a twist. For this roll no pressure is required, but keep on breaking up the leaf with the hand while rolling is going on.

Break up the roll, either by the hand or a Roll-breaker.

Fire off at a temperature of about 200°.

Although a Roll-breaker does to some extent break up the lumps, women should be employed to do this after the leaf has been through the Roll-breaker. If carefully done it should not increase the percentage of dust.

No automatic drier, such as a Colombo drier or Venetian, is in the least good for first drying; a machine is required in which the trays can "be got at" as leaf sticks to the trays.

General.—As regards plucking—"Bhanji" of coarse quality should be avoided as it makes yellow leaf, answering to red leaf in Black Teas. The leaf should be steamed and made into tea as soon as plucked, and the morning leaf can be made before the afternoon leaf comes in.

A golden rule is to get the leaf into the steamer as soon as possible after it has been plucked. It would be therefore desirable to steam all the leaf and keep it spread thinly on the floor until it can be worked off. Fermented leaf or much bruised leaf will spoil the liquor by darkening it and a large percentage of brown leaf will be noticeable. If the press of crop is such that a large amount of leaf comes in the evening, and if not desirable of working off that night, it would be very advisable to steam the leaf and press in a Presser, if the weather is wet, and spread evenly on the tata. If not withered the following morning to 45-50% wither, it should be passed through the driers until properly withered; then roll without weight of any sort for 40 minutes; then pass through Roll-breaker and re-roll again for 30 minutes or until it produces a good twist, then pass through Roll-breaker again; after this fire at a temperature of 200°-220°.

If leaf is exposed to sun while in the basket of the pluckers or bruised by cramming in too tightly, a certain amount of fermentation will take place, which will spoil the liquor by darkening it, and also the out-turn in which no brown leaves should be discernible—in wet weather there is not much fear of damage, but in the hot sun the greatest care must be taken in the field to keep leaf fresh and unwithered.

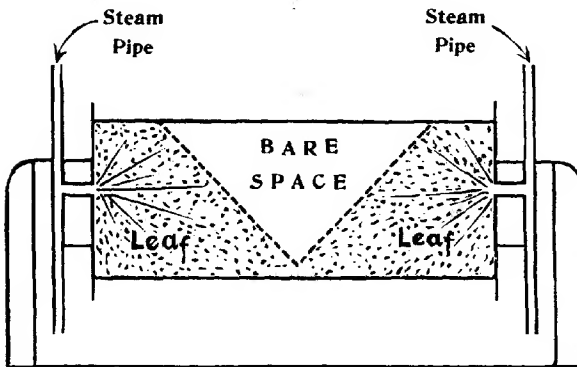
After the first firing, the end of the leaf will be crisp if the operation is properly carried out. It must on no account be rolled in this condition, and if spread for a time it will be found that the crispness will disappear and the whole of the leaf regain its softness when it will be ready to re-roll. It is upon these small points that the avoidance of the undesirable dust and fannings depends.

In firing there is a tendency for the leaf to stick to the trays at first, but after being a short time subjected to the hot air this stickiness disappears. Do not, therefore, attempt to turn the leaf at first, or breakage and fannings will result. Wait till firing is about half finished when the leaf may be turned without injury. This is another cause of broken leaf, etc., when carelessly handled.

Treat the leaf and tea carefully at all stages. Green tea is fragile more so than black, and it is worth trouble to improve the proportion of

leaf grades. Ninety per cent. clean leaf at least should be obtained, and there are many gardens which obtain more.

In Up-country estates with an elevation of, say, 3,000 ft. and over the leaf, after being steamed and cooled, should be spread on the tats for 18 hours (not more) and then the usual system of manufacture adopted. In the manufacture of Green Tea in the low-country the percentage of made Tea is slightly lower than in Black. This is lost during the first roll, and, if the above method is carried out, there will be no loss. When passing through the rolled leaf through roll breakers it is essential that the sifter tray with mesh be removed and only the breaking battens used to break up the lumps—otherwise when passing over the tray the leaf is formed into balls like horse dung. The best way to put the leaf into the steamer is as per illustration (attached). This insures the leaf being uniformly steamed.



HESSIAN TATS.

2 $\frac{1}{8}$ linear feet required to one square foot floor. Six or if thinly spread 10 square feet of hessian will be required for 1 lb. of leaf. Cost inclusive of timber, screws, jute hessian and labour 4 cents per square foot. Fairweather's tats, including timber, wire, hooks, hessian and fixing up cost about 25 cents per square foot of floor.

Six boys and a head cooly will attend to 5,000 lbs. leaf a day.

One hundred lbs. green leaf withers down to from 45 to 67 lbs. and turns out 23 to 25 lbs. tea.

N. R. CAMERON

Cost of Rearing Tea Plants per 1,000 allowing Rs. 2 per 1,000 for Nurseries and watering—H. K. R.

| Cost of seed per maund. | COST OF PLANTS PER 1,000 AT VARIOUS OUTTURNS. | | | | |
|-------------------------|---|-------------------|--------------------|--------------------|--------------------|
| | 6,000 to a maund. | 8,000 to a maund. | 10,000 to a maund. | 15,000 to a maund. | 20,000 to a maund. |
| Rs. 30 | 7-00 | 5-75 | 5-00 | 4-00 | 3-50 |
| 35 | 7-83 | 6-37 | 5-50 | 4-33 | 3-75 |
| 40 | 8-67 | 7-00 | 6-00 | 4-87 | 4-00 |
| 45 | 9-50 | 7-62 | 6-50 | 5-00 | 4-25 |
| 50 | 10-33 | 8-25 | 7-00 | 5-33 | 4-50 |
| 55 | 11-16 | 8-87 | 7-50 | 5-67 | 4-75 |
| 60 | 12-00 | 9-50 | 8-00 | 6-00 | 5-00 |
| 65 | 12-83 | 10-12 | 8-50 | 6-33 | 5-25 |
| 70 | 13-67 | 10-75 | 9-00 | 6-67 | 5-50 |
| 75 | 14-50 | 11-37 | 9-50 | 7-00 | 5-75 |
| 80 | 15-33 | 12-00 | 10-00 | 7-33 | 6-00 |
| 85 | 16-16 | 12-62 | 10-50 | 7-67 | 6-25 |
| 90 | 17-00 | 13-25 | 11-00 | 8-00 | 6-50 |
| 95 | 17-83 | 13-87 | 11-50 | 8-33 | 6-75 |
| 100 | 18-67 | 14-50 | 12-00 | 8-67 | 7-00 |
| 105 | 19-50 | 15-12 | 12-50 | 9-00 | 7-25 |
| 110 | 20-33 | 15-75 | 13-00 | 9-33 | 7-50 |
| 115 | 21-16 | 16-37 | 13-50 | 9-67 | 7-75 |
| 120 | 22-00 | 17-00 | 14-00 | 10-00 | 8-00 |
| 125 | 22-83 | 17-62 | 14-50 | 10-33 | 8-25 |
| 130 | 23-67 | 18-25 | 15-00 | 10-67 | 8-50 |

CULTIVATION OF TEA LAND AND COST OF OPENING.

Planting 4 ft. by 3½ ft. say, 3,000 plants to an acre.

| | | | | | FROM | TO |
|------------------------------------|-----|-----|-----------|--|------|-----|
| | | | | | Rs. | Rs. |
| Felling and Clearing | ... | ... | per acre. | | 9 | 16 |
| Lining, including pegs | ... | ... | do | | 3½ | 4½ |
| Holing | ... | ... | do | | 9 | 11 |
| Filling in | ... | ... | do | | 3½ | 4 |
| Planting and Supplying | ... | ... | do | | 5 | 10 |
| Shading | ... | ... | do | | 4 | 7 |
| Roading | ... | ... | do | | 10 | 12 |
| Draining | ... | ... | do | | 10 | 14 |
| Weeding | ... | ... | do | | 10 | 14 |
| Topping | ... | ... | do | | 1½ | 2½ |
| Pruning | ... | ... | do | | 5 | 10 |
| Collar Pruning | ... | ... | do | | 4 | 5 |
| Roads and Drains upkeep | ... | ... | do | | 1 | 2 |
| Tea plants | ... | ... | do | | 20 | 30 |
| Tea stumps | ... | ... | do | | 30 | 45 |
| Lines, Temporary thatched per room | ... | ... | | | 10 | 20 |
| Do Permanent shingle roof | ... | ... | | | 50 | 60 |
| Do do iron roof with drains | ... | ... | | | 90 | 115 |
| Do do tiles (on estate) | ... | ... | | | 65 | 90 |

COST OF TEA PER LB.

Average cost of production on a low-country Estate for 10 years.

| GENERAL CHARGES. | | | | Cents. | Cents. |
|------------------|-----|-----|-----|----------|--------|
| Superintendence | ... | ... | ... | 1.93 | |
| Allowances | ... | ... | ... | .21 | |
| Contingencies | ... | ... | ... | .58 | |
| Bungalows | ... | ... | ... | .25 | |
| Lines | ... | ... | ... | .60 | |
| Factory | ... | ... | ... | .54 | |
| Tools, Machinery | ... | ... | ... | .51 | |
| Agency Charges | ... | ... | ... | .31 | |
| TEA MANUFACTURE. | | | | | 4.93 |
| Roads | ... | ... | ... | .12 | |
| Drains | ... | ... | ... | .18 | |
| Weeding | ... | ... | ... | 2.25 | |
| Pruning | ... | ... | ... | .67 | |
| Manuring | ... | ... | ... | 2.90 | |
| Burying Prunings | ... | ... | ... | 1.12 | |
| Boundaries | ... | ... | ... | .07 | |
| TEA PLUCKING. | | | | | 7.31 |
| Plucking | ... | ... | ... | 7.35 | |
| Manufacture | ... | ... | ... | 1.26 | |
| Packing | ... | ... | ... | 2.25 | |
| Fuel | ... | ... | ... | 1.16 | |
| Transport | ... | ... | ... | .52 | |
| Factory Sundries | ... | ... | ... | .09 | |
| Shipping Charges | ... | ... | ... | .37 | |
| | | | | | 13.00 |
| | | | | Cents... | 25.24 |

Approximate Cost of Producing Tea per lb. on an Estate of 400 Acres at Varying Yields from 250 lbs. to 600 lbs. per Acre.

| Yield per acre. lbs. | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 |
|--|-------|-------|-------|-------|-------|-------|-------|------|
| Salaries, Medicines, General Charges and Contingencies | 9-00 | 8-10 | 7-30 | 6-40 | 5-60 | 4-70 | 4-40 | 4-00 |
| Cultivation Exclu- sive of Manuring. | 8-00 | 7-20 | 6-50 | 5-70 | 4-90 | 4-15 | 4-05 | 4-00 |
| Plucking | 12-50 | 11-80 | 11-00 | 10-20 | 9-60 | 8-90 | 8-45 | 8-00 |
| Manufacture f.o. b. | 8-00 | 7-60 | 7-30 | 7-00 | 6-60 | 6-25 | 6-10 | 6-00 |
| Upkeep of Factory and Machinery | 1-00 | 1-00 | 1-00 | 1-00 | 1-00 | 1-00 | 1-00 | 1-00 |
| Total Cost in Cents per lb. of Tea | 38-50 | 35-70 | 33-10 | 30-30 | 27-70 | 25-00 | 24-00 | 23-0 |

N. B.—6 to 7 lbs. per lb. is spent in addition to this on manuring on most Estates in Ceylon.

On Estates of larger acreages with Factories purchasing leaf and manufacturing Tea for others on a large scale, tea can be put f. o. b. Colombo at 21 cents per lb.

COLOMBO CHARGES.

Receiving at Railway or Boats and placing on board

Steamer inclusive of Export duty at 10 cts.

per cwt. and Harbour dues cts. 0-50 per lb.

Special duty imposed by Cess Ordinance 0-30 ..

Total... 80 of a cent.

Harbour dues payable on tea when exported :— $1\frac{1}{2}$ ct. per lb. Export Duty. For five days and under—on each box of tea on net weights as marked on each package.

For every 50 lbs. 3 cents

For every additional 50 lbs. or fraction thereof ... 3 ..

Package or box of less weight 2 ..

TRANSPORT BASKETS.

Capacity 60 lbs., weight 7 lbs., cost Kalutara cane Rs. 1-50, cost whole cane Rs. 2-25.

Capacity 75 lbs., weight 9 lbs., cost Bamboo 75 cents.

Table Showing Percentage of Profit on Tea Property at Varying Capitals per Acre, Varying Yields per Acre, and Varying Profits per lb. of Tea—H. K. R. *

| Capital per Acre. | | | At 1 penny per lb. Profit. | | | | | At 2 pence per lb. Profit. | | | | |
|-------------------|----|----|----------------------------|------|------|------|------|----------------------------|------|------|-------|-------|
| | | | lbs. per Acre. | | | | | lbs. per Acre. | | | | |
| £ | s. | d. | 200 | 300 | 400 | 500 | 600 | 200 | 300 | 400 | 500 | 600 |
| 104 | 3 | 4 | -40 | -60 | -80 | 1'00 | 1'20 | -80 | 1'20 | 1'60 | 2'00 | 2'40 |
| 98 | 19 | 2 | -42 | -63 | -84 | 1'05 | 1'26 | -84 | 1'33 | 1'66 | 2'00 | 2'40 |
| 93 | 15 | 0 | -44 | -66 | -88 | 1'11 | 1'33 | -89 | 1'33 | 1'77 | 2'22 | 2'66 |
| 88 | 10 | 10 | -47 | -70 | -94 | 1'17 | 1'41 | -94 | 1'41 | 1'88 | 2'35 | 2'82 |
| 83 | 6 | 8 | -50 | -75 | 1'00 | 1'25 | 1'50 | 1'00 | 1'50 | 2'00 | 2'50 | 3'00 |
| 78 | 2 | 6 | -53 | -80 | 1'06 | 1'33 | 1'60 | 1'06 | 1'60 | 2'13 | 2'68 | 3'20 |
| 72 | 18 | 4 | -57 | -85 | 1'14 | 1'42 | 1'71 | 1'14 | 1'71 | 2'28 | 2'85 | 3'42 |
| 67 | 14 | 8 | -61 | -92 | 1'23 | 1'53 | 1'84 | 1'23 | 1'84 | 2'46 | 3'07 | 3'68 |
| 62 | 10 | 0 | -65 | 1'00 | 1'33 | 1'66 | 2'00 | 1'33 | 2'00 | 2'66 | 3'33 | 4'00 |
| 57 | 5 | 10 | -72 | 1'09 | 1'45 | 1'81 | 2'18 | 1'45 | 2'18 | 2'90 | 3'63 | 4'36 |
| 52 | 1 | 8 | -80 | 1'20 | 1'60 | 2'00 | 2'40 | 1'60 | 2'40 | 3'20 | 4'00 | 4'80 |
| 46 | 17 | 6 | -88 | 1'33 | 1'77 | 2'22 | 2'66 | 1'70 | 2'66 | 3'55 | 4'44 | 5'33 |
| 41 | 13 | 4 | 1'00 | 1'50 | 2'00 | 2'50 | 3'00 | 2'00 | 3'00 | 4'00 | 5'00 | 6'00 |
| 36 | 8 | 2 | 1'14 | 1'71 | 2'28 | 2'85 | 3'43 | 2'28 | 3'43 | 4'56 | 5'71 | 6'86 |
| 31 | 5 | 0 | 1'33 | 2'00 | 2'66 | 3'33 | 4'00 | 2'66 | 4'00 | 5'33 | 6'66 | 8'00 |
| 26 | 0 | 10 | 1'60 | 2'40 | 3'20 | 4'00 | 4'80 | 3'20 | 4'80 | 6'40 | 8'00 | 9'60 |
| 20 | 18 | 8 | 2'00 | 3'00 | 4'00 | 5'00 | 6'00 | 4'00 | 6'00 | 8'00 | 10'00 | 12'00 |

Table Showing Percentage of Profit on Tea Property at Varying Capitals per Acre, Varying Yields per Acre, and Varying Profits per lb. of Tea.—H. K. R.

| Capital per Acre. | | | At 3 pence per lb. Profit. | | | | | At 4 pence per lb. Profit. | | | | | At 5 pence per lb. Profit. | | | | |
|----------------------|----|----|----------------------------|-------|-------|-------|-------|----------------------------|-------|-------|-------|-------|----------------------------|-------|-------|-------|-------|
| | | | lbs. per Acre. | | | | | lbs. per Acre. | | | | | lbs. per Acre. | | | | |
| | | | 200 | 300 | 400 | 500 | 600 | 200 | 300 | 400 | 500 | 600 | 200 | 300 | 400 | 500 | 600 |
| £ | s. | d. | | | | | | | | | | | | | | | |
| 104 | 3 | 4 | 2-40 | 3-60 | 4-80 | 6-00 | 7-20 | 3-20 | 4-80 | 6-40 | 8-00 | 9-60 | 4-00 | 6-00 | 8-00 | 10-00 | 12-00 |
| 98 | 19 | 2 | 2-52 | 3-78 | 5-05 | 6-31 | 7-57 | 3-36 | 5-05 | 6-73 | 8-42 | 10-10 | 4-21 | 6-31 | 8-42 | 10-52 | 12-63 |
| 93 | 15 | 0 | 2-66 | 4-00 | 5-35 | 6-66 | 8-00 | 3-55 | 5-23 | 7-11 | 8-88 | 10-66 | 4-44 | 6-66 | 8-88 | 11-11 | 13-33 |
| 88 | 10 | 10 | 2-82 | 4-23 | 5-65 | 7-06 | 8-40 | 3-76 | 5-65 | 7-63 | 9-61 | 11-59 | 4-70 | 7-06 | 9-40 | 11-76 | 14-12 |
| 83 | 6 | 8 | 3-00 | 4-50 | 6-00 | 7-50 | 9-00 | 4-00 | 6-00 | 8-00 | 10-00 | 12-00 | 5-00 | 7-50 | 10-00 | 12-50 | 15-00 |
| 78 | 2 | 6 | 3-20 | 4-80 | 6-40 | 8-00 | 9-60 | 4-28 | 6-40 | 8-53 | 10-60 | 12-80 | 5-33 | 8-00 | 10-60 | 13-33 | 16-00 |
| 72 | 18 | 4 | 3-42 | 5-14 | 6-85 | 8-57 | 10-27 | 4-57 | 6-85 | 9-13 | 11-42 | 13-71 | 5-71 | 8-57 | 11-42 | 14-28 | 17-14 |
| 67 | 14 | 2 | 3-69 | 5-53 | 7-38 | 9-22 | 11-08 | 4-92 | 7-38 | 9-84 | 12-33 | 14-76 | 6-11 | 9-22 | 12-30 | 15-36 | 18-46 |
| 62 | 10 | 0 | 4-00 | 6-00 | 8-00 | 10-00 | 12-00 | 5-33 | 8-00 | 10-66 | 13-33 | 16-00 | 6-66 | 10-00 | 13-33 | 16-66 | 20-00 |
| 57 | 5 | 10 | 4-36 | 6-64 | 8-72 | 10-90 | 13-18 | 5-81 | 8-72 | 11-63 | 14-55 | 17-45 | 7-27 | 10-90 | 14-55 | 18-18 | 21-81 |
| 52 | 1 | 8 | 4-60 | 7-20 | 9-60 | 12-00 | 14-40 | 6-40 | 9-60 | 12-80 | 16-00 | 19-20 | 8-00 | 12-00 | 16-00 | 20-00 | 24-00 |
| 46 | 17 | 6 | 5-33 | 8-00 | 10-66 | 13-33 | 16-00 | 7-11 | 10-66 | 14-22 | 17-77 | 21-33 | 8-88 | 13-33 | 17-77 | 22-22 | 26-66 |
| 41 | 13 | 4 | 6-00 | 9-00 | 12-00 | 15-00 | 18-00 | 8-00 | 12-00 | 16-00 | 20-00 | 24-00 | 10-00 | 15-00 | 20-00 | 25-00 | 30-00 |
| 36 | 9 | 2 | 6-66 | 10-26 | 13-70 | 17-13 | 20-57 | 9-14 | 13-70 | 19-28 | 22-88 | 27-42 | 11-45 | 17-13 | 22-88 | 28-57 | 34-28 |
| 31 | 5 | 0 | 8-00 | 12-00 | 16-00 | 20-00 | 24-00 | 10-66 | 16-00 | 21-33 | 26-66 | 32-00 | 13-33 | 20-00 | 26-66 | 33-33 | 40-00 |
| 26 | 0 | 10 | 9-60 | 14-40 | 19-20 | 24-00 | 28-80 | 12-80 | 19-20 | 25-60 | 32-00 | 38-40 | 16-00 | 24-00 | 32-00 | 40-00 | 48-00 |
| 20 | 8 | 12 | 12-00 | 18-00 | 24-00 | 30-00 | 36-00 | 16-00 | 24-00 | 32-00 | 40-00 | 48-00 | 20-00 | 30-00 | 40-00 | 50-00 | 60-00 |

ANALYSIS OF THE PRUNINGS OF TEA BUSHES.

Pruning of 10 Bushes were taken from each of the undermentioned Estates and the calculations are based on 3,500 trees per acre :—

| | PITAKANDU GROUP, MATALE. | | | SUNNYCROFT, VEYANGODA. | | |
|-----------------------------|---|-----------------------------|----------------------------|---|-----------------------------|----------------------------|
| Weight of Prunings. | Bran- ches 73 lbs. | Leaves 35½ lbs. | | Bran- ches 29·20 lbs. | Leaves 14·30 lbs. | |
| Analysis. | Bran- ches and twigs lbs. per acre. | Leaves lbs. per acre. | Total lbs. per acre. | Bran- ches and twigs lbs. per acre. | Leaves lbs. per acre. | Total lbs. per acre. |
| Dry Matter ... | 13,943·45 | 4,959·85 | 18,003·30 | 5,988·50 | 1,918·00 | 7,906·50 |
| Nitrogen ... | 88·83 | 114·14 | 202·97 | 82·98 | 88·42 | 171·40 |
| Total Ash ... | 269·46 | 448·67 | 718·13 | 158·55 | 168·00 | 326·55 |
| Lime ... | 63·56 | 139·16 | 202·72 | 45·50 | 54·92 | 100·42 |
| Magnesia ... | 20·83 | 32·62 | 53·45 | 16·59 | 17·46 | 34·05 |
| Potash ... | 62·47 | 53·53 | 115·99 | 40·81 | 59·88 | 100·69 |
| Phosphoric Acid | 24·36 | 22·86 | 47·22 | 6·98 | 24·05 | 31·03 |
| Oxide of Mangan- ese ... | 4·03 | 7·63 | 11·66 | 1·99 | 4·65 | 6·64 |

VALUE OF GREEN TEA LEAF.

- a = Value of tea per lb. in cents Colombo,
 b = Cost of Manufacture per lb. f. o. b. Colombo.
 c = Profit per lb. manufactured.
 V = Value of one pound green leaf.

$$V = \frac{a - (b + c)}{4}$$

NUMBER OF TREES PRUNED.

| Distance of trees. | COST PER ACRE. | | | | | | |
|-----------------------|----------------|-------|-------|-------|-------|-------|--------|
| | Rs. 4 | Rs. 5 | Rs. 6 | Rs. 7 | Rs. 8 | Rs. 9 | Rs. 10 |
| 5 × 5 | 158 | 124 | 103 | 87 | 76 | 67 | 60 |
| 5 × 4 | 198 | 156 | 128 | 108 | 90 | 84 | 75 |
| 4½ × 4 | 220 | 173 | 142 | 121 | 105 | 93 | 84 |
| 4 × 4 | 248 | 194 | 160 | 136 | 118 | 105 | 94 |
| 4 × 3½ | 283 | 222 | 183 | 155 | 135 | 120 | 107 |
| 4 × 3 | 330 | 259 | 213 | 181 | 158 | 140 | 125 |
| 3½ × 3½ | 323 | 254 | 209 | 177 | 155 | 137 | 123 |
| 3½ × 3 | 377 | 296 | 244 | 207 | 180 | 160 | 143 |
| 3 × 3 | 440 | 346 | 285 | 242 | 210 | 186 | 167 |
| Coolies per Acre. | 11 | 14 | 17 | 20 | 23 | 26 | 29 |

PLUCKING TEA LEAF.

Approximate cost of plucking per lb. of made Tea at various yields per acre
and green leaf plucked per cooly per day.—H.K.R.

| Yield per acre. | Average lbs. green leaf plucked per cooly per day during the Year. | Cost of plucking (including baskets) per lb. made tea. |
|--------------------|---|--|
| 100 lbs. | 10-00 | 14-00 |
| 200 lbs. | 11-02 | 12-70 |
| 300 lbs. | 11-86 | 11-80 |
| 400 lbs. | 13-72 | 10-20 |
| 500 lbs. | 15-72 | 8-90 |
| 600 lbs. | 17-50 | 8-00 |
| 700 lbs. | 17-84 | 7-90 |
| 800 lbs. | 18-06 | 7-75 |
| 900 lbs. | 19-04 | 7-35 |
| 1,000 lbs. | 20-00 | 7-00 |

Equivalent Value of Teas in Colombo to London Prices in Pence, Freight,
Insurance, and Charges, 1½d. per lb.

| London Price per lb. | | EXCHANGE RATES. | | | | | | | | |
|-------------------------|-------|-----------------|-------|-------|-------|-------|-------|-------|-------|--|
| | 1/3 | 1/3½ | 1/3¾ | 1/3⅞ | 1/4 | 1/4½ | 1/4¾ | 1/4⅞ | 1/5 | |
| Charges. | 8 33 | 8 19 | 8 06 | 7 93 | 7 81 | 7 69 | 7 57 | 7 46 | 7 35 | |
| 3 | 11 67 | 11 48 | 11 28 | 11 10 | 10 98 | 10 76 | 10 60 | 10 44 | 10 25 | |
| 3½ | 13 33 | 13 12 | 12 89 | 12 69 | 12 49 | 12 30 | 12 11 | 11 93 | 11 72 | |
| 3¾ | 15 00 | 14 76 | 14 50 | 14 28 | 14 05 | 13 84 | 13 63 | 13 42 | 13 19 | |
| 4 | 16 66 | 16 40 | 16 11 | 15 87 | 15 61 | 15 38 | 15 15 | 14 91 | 14 66 | |
| 4½ | 18 33 | 18 03 | 17 73 | 17 46 | 17 18 | 16 91 | 16 67 | 16 41 | 16 12 | |
| 4¾ | 19 99 | 19 67 | 19 34 | 19 05 | 18 74 | 18 45 | 18 18 | 17 90 | 17 59 | |
| 4⅞ | 21 66 | 21 31 | 20 95 | 20 64 | 20 30 | 20 00 | 19 70 | 19 39 | 19 06 | |
| 5 | 23 32 | 22 95 | 22 56 | 22 23 | 21 86 | 21 53 | 21 21 | 20 88 | 20 53 | |
| 5½ | 24 99 | 24 59 | 24 18 | 23 81 | 23 43 | 23 07 | 22 73 | 22 38 | 21 99 | |
| 5¾ | 26 65 | 26 23 | 25 79 | 25 40 | 24 99 | 24 61 | 24 24 | 23 87 | 23 46 | |
| 5⅞ | 28 32 | 27 87 | 27 40 | 26 99 | 26 55 | 26 15 | 25 76 | 25 36 | 24 93 | |
| 6 | 29 98 | 29 51 | 29 01 | 28 58 | 28 11 | 27 69 | 27 27 | 26 85 | 26 40 | |
| 6½ | 31 65 | 31 14 | 30 62 | 31 16 | 29 67 | 29 22 | 28 79 | 28 35 | 27 86 | |
| 6¾ | 33 31 | 32 78 | 32 23 | 31 75 | 31 23 | 30 76 | 30 30 | 29 84 | 29 33 | |
| 6⅞ | 34 98 | 34 42 | 33 84 | 33 33 | 32 89 | 32 30 | 31 82 | 31 33 | 30 80 | |
| 7 | 36 64 | 36 06 | 35 45 | 34 92 | 34 35 | 33 84 | 33 33 | 32 82 | 32 27 | |
| 7½ | 38 31 | 37 70 | 37 07 | 36 50 | 35 92 | 35 37 | 34 85 | 34 32 | 33 73 | |
| 7¾ | 39 97 | 39 34 | 38 68 | 38 09 | 37 48 | 36 91 | 36 36 | 35 81 | 35 26 | |
| 7⅞ | 41 64 | 40 98 | 40 29 | 39 68 | 39 04 | 38 45 | 37 88 | 37 30 | 36 67 | |
| 8 | 43 30 | 42 62 | 41 90 | 41 27 | 40 60 | 39 99 | 39 39 | 38 79 | 38 14 | |
| 8½ | 44 97 | 44 25 | 43 52 | 42 85 | 42 17 | 41 52 | 40 91 | 40 29 | 39 60 | |
| 8¾ | 46 63 | 45 89 | 45 13 | 44 44 | 43 73 | 43 06 | 42 42 | 41 78 | 41 07 | |
| 8⅞ | 48 30 | 47 53 | 46 74 | 46 03 | 45 29 | 44 60 | 43 94 | 43 27 | 42 54 | |
| 9 | 49 96 | 49 17 | 48 35 | 47 62 | 46 85 | 46 14 | 45 45 | 44 76 | 44 01 | |
| 9½ | 51 63 | 50 81 | 49 97 | 49 20 | 48 42 | 47 67 | 46 97 | 46 26 | 45 47 | |
| 9¾ | 53 29 | 52 45 | 51 58 | 50 79 | 49 98 | 49 21 | 48 48 | 47 75 | 46 94 | |
| 9⅞ | 54 96 | 54 09 | 53 19 | 52 38 | 51 54 | 50 76 | 50 00 | 49 24 | 48 41 | |
| 10 | 56 62 | 55 73 | 54 80 | 53 96 | 53 10 | 52 29 | 51 51 | 50 73 | 49 88 | |
| 10½ | 58 29 | 57 37 | 56 41 | 55 55 | 54 66 | 53 83 | 53 03 | 52 23 | 51 33 | |
| 10¾ | 59 95 | 59 01 | 58 02 | 57 14 | 56 22 | 55 37 | 54 54 | 53 72 | 52 80 | |
| 10⅞ | 61 62 | 60 65 | 59 63 | 58 72 | 57 78 | 56 91 | 56 06 | 55 21 | 54 27 | |
| 11 | 63 28 | 62 29 | 61 24 | 60 31 | 59 34 | 58 45 | 57 57 | 56 70 | 55 74 | |
| 11½ | 64 95 | 63 82 | 62 86 | 61 89 | 60 91 | 59 98 | 59 09 | 58 20 | 57 20 | |
| 11¾ | 66 61 | 65 56 | 64 47 | 63 48 | 62 47 | 61 52 | 60 60 | 59 69 | 58 67 | |
| 11⅞ | 68 28 | 67 20 | 66 08 | 65 07 | 64 03 | 63 06 | 62 12 | 61 18 | 60 14 | |
| 12 | 69 94 | 68 84 | 67 69 | 66 66 | 65 59 | 64 60 | 63 63 | 62 67 | 61 61 | |
| 12½ | 71 61 | 70 48 | 69 31 | 68 24 | 67 16 | 66 13 | 65 15 | 64 17 | 63 06 | |
| 12¾ | 73 27 | 72 12 | 70 92 | 69 83 | 68 72 | 67 67 | 66 66 | 65 68 | 64 53 | |
| 12⅞ | 74 94 | 73 76 | 72 53 | 71 42 | 70 28 | 69 21 | 68 18 | 67 15 | 66 00 | |
| 13 | 76 60 | 75 40 | 74 14 | 73 01 | 71 84 | 70 75 | 69 69 | 68 64 | 67 47 | |
| 13½ | 78 27 | 77 03 | 75 76 | 74 59 | 73 41 | 72 28 | 71 21 | 70 14 | 68 93 | |
| 13¾ | 79 93 | 78 67 | 77 37 | 76 18 | 74 97 | 73 82 | 72 72 | 71 63 | 70 40 | |
| 13⅞ | 81 60 | 80 31 | 78 96 | 77 77 | 76 53 | 75 36 | 74 24 | 73 12 | 71 87 | |

**Equivalent Value of Teas in Colombo to London Prices in Pence, Freight,
Insurance, and Charges. 1½d. per lb.—(Contd.)**

| London Price per lb. | EXCHANGE RATES. | | | | | | | | | |
|--|-----------------|--------|--------|--------|--------|--------|--------|--------|-------|--|
| | 1/3 | 1/3½ | 1/3½ | 1/3½ | 1/4 | 1/4½ | 1/4½ | 1/4½ | 1/5 | |
| Charges. | 8-33 | 8-19 | 8-06 | 7-93 | 7-81 | 7-69 | 7-57 | 7-46 | 7-35 | |
| 13½ | 83-26 | 81-95 | 80-59 | 79-36 | 78-09 | 76-96 | 75-75 | 74-61 | 73-34 | |
| 14 | 84-93 | 83-59 | 82-21 | 80-94 | 79-66 | 78-43 | 77-27 | 76-11 | 74-80 | |
| 14½ | 86-59 | 85-23 | 83-82 | 82-53 | 81-22 | 79-97 | 78-78 | 77-60 | 76-27 | |
| 14½ | 88-26 | 86-87 | 85-42 | 84-12 | 82-78 | 81-51 | 80-30 | 79-09 | 77-74 | |
| 14½ | 89-92 | 88-51 | 87-04 | 85-71 | 84-34 | 83-05 | 81-81 | 80-58 | 79-21 | |
| 15 | 91-59 | 90-15 | 88-66 | 87-29 | 85-91 | 84-59 | 83-33 | 82-08 | 80-67 | |
| 15½ | 93-25 | 91-79 | 90-27 | 88-88 | 87-47 | 86-13 | 84-84 | 83-57 | 82-14 | |
| 15½ | 94-92 | 93-43 | 91-88 | 90-47 | 89-03 | 87-67 | 86-36 | 85-06 | 83-61 | |
| 15½ | 96-58 | 95-07 | 93-49 | 92-05 | 90-59 | 89-21 | 87-87 | 86-55 | 85-08 | |
| 16 | 98-25 | 96-71 | 95-10 | 93-64 | 92-15 | 90-74 | 89-39 | 88-05 | 86-53 | |
| 16½ | 99-91 | 98-35 | 96-71 | 95-23 | 93-71 | 92-28 | 90-90 | 89-54 | 88-00 | |
| 16½ | 101-58 | 99-99 | 98-32 | 96-81 | 95-27 | 93-82 | 92-42 | 91-03 | 89-47 | |
| 16½ | 103-24 | 101-63 | 99-93 | 98-40 | 96-83 | 95-36 | 93-93 | 92-52 | 90-94 | |
| 17 | 104-91 | 103-26 | 101-55 | 99-98 | 98-40 | 96-89 | 95-45 | 94-02 | 92-40 | |
| 17½ | 106-57 | 104-90 | 103-16 | 101-57 | 99-96 | 98-43 | 96-96 | 95-51 | 93-87 | |
| 17½ | 108-24 | 106-54 | 104-77 | 103-16 | 101-52 | 99-97 | 98-98 | 97-00 | 95-34 | |
| 17½ | 109-90 | 108-18 | 106-38 | 104-75 | 103-08 | 101-51 | 99-99 | 98-49 | 96-81 | |
| 18 | 111-57 | 109-81 | 108-00 | 106-33 | 104-65 | 103-04 | 101-51 | 100-00 | 98-27 | |
| Add for every ½d. charges less than 1½d. | 1-66 | 1-64 | 1-61 | 1-59 | 1-56 | 1-54 | 1-52 | 1-49 | 1-47 | |

LEAF TRANSPORT.

By Rail :—Baskets weigh 10 to 16 per cent. of net weight of leaf.

Leaf Carts :—Small size for single bullock to take 10 baskets.

24 in. x 18 in. each basket holding 35 lbs. ... Rs. 130

Large size for 2 bullocks to take 28 baskets .. „ 185

STATEMENT SHOWING APPORTIONMENT OF CHARGES OF COST OF
PRODUCING A CEYLON TEA CROP OF 140 MILLION LBS. OF TEA

F. O. B. COLOMBO.—H. K. R.

| Establishment— | £ | Percentages. | |
|---|-------------------|---------------|--|
| Salaries | 345,333 | 13·97 | |
| Allowances | 23,333 | ·94 | |
| Contingencies | 60,667 | 2·45 | |
| | <u>£429,333</u> | <u>17·36</u> | |
| Cultivation— | | | |
| Roads and Drains | 28,000 | 1·13 | |
| Weeding | 242,667 | 9·81 | |
| Pruning | 79,333 | 3·21 | |
| Supplying | 9,333 | ·38 | |
| Manuring | 112,000 | 4·52 | |
| Grass and Cattle | 28,000 | 1·13 | |
| Fences and Boundaries | 1,867 | ·08 | |
| Tools | 10,267 | ·41 | |
| Removing Diseases | 11,200 | ·45 | |
| Forest Reserves | 9,333 | ·38 | |
| | <u>£532,000</u> | <u>21·50</u> | |
| Manufacture, etc.— | | | |
| Plucking and Baskets | 849,334 | 34·34 | |
| Firewood and Fuel | 93,333 | 3·78 | |
| Tea House Labour | 75,600 | 3·05 | |
| Packing Materials | 224,000 | 9·05 | |
| Transport of Tea | 84,000 | 3·40 | |
| Colombo Shipping Charges | 56,000 | 2·27 | |
| Tea House Sundries | 7,466 | ·31 | |
| Up-keep of Machinery | 38,267 | 1·54 | |
| Do Buildings | 84,000 | 3·40 | |
| | <u>£1,512,000</u> | <u>61·14</u> | |
| | <u>£2,473,333</u> | <u>100·00</u> | |
| Cost f. o. b. Colombo = 26½ cents = 4·24d. per lb. @ 1¼d. exchange. | | | |

GREEN LEAF SIFTERS.

Ordinary Dimensions :— $\frac{3}{4}$ inch mesh.

| | | |
|---------------------|-----|-----------------|
| Length | ... | 9 feet 0 inches |
| Diameter, large end | ... | 3 „ 6 „ |
| Do. small „ | ... | 1 „ 6 „ |

SATURATED MIXTURE OF AIR AND AQUEOUS VAPOUR.

| Temperature degrees Fahr. | Weight of 100 cub. ft. of mixture in lbs. | Weight of water in 100 cub. ft. of mixture in lbs. | Per cent. of water in mixture. | Heat units in 100 cub. ft. of mixture. | Per cent. of heat in Vapour. | Temperature degrees Fahr. | Weight of 100 cub. ft. of mixture in lbs. | Weight of water in 100 cub. ft. of mixture in lbs. | Per cent. of water in mixture. | Heat units in 100 cub. ft. of mixture. | Per cent. of heat in Vapour. |
|------------------------------|--|--|-----------------------------------|---|---------------------------------|------------------------------|--|--|-----------------------------------|---|---------------------------------|
| 35 | 8.004 | 0.034 | 0.42 | 42.8 | 86.69 | 100 | 6.924 | 0.283 | 4.08 | 422.074.58 | |
| 40 | 7.920 | 0.041 | 0.52 | 59.8 | 76.59 | 105 | 6.830 | 0.325 | 4.76 | 474.776.22 | |
| 45 | 7.834 | 0.049 | 0.62 | 77.7 | 68.98 | 110 | 6.741 | 0.373 | 5.23 | 533.977.88 | |
| 50 | 7.752 | 0.059 | 0.76 | 97.6 | 66.29 | 115 | 6.650 | 0.426 | 6.41 | 599.179.52 | |
| 55 | 7.688 | 0.070 | 0.91 | 118.3 | 64.58 | 120 | 6.551 | 0.488 | 7.46 | 672.481.14 | |
| 60 | 7.589 | 0.082 | 1.08 | 140.1 | 64.31 | 125 | 6.454 | 0.554 | 8.55 | 750.582.62 | |
| 65 | 7.507 | 0.097 | 1.29 | 164.9 | 64.78 | 130 | 6.347 | 0.630 | 9.90 | 839.484.13 | |
| 70 | 7.425 | 0.114 | 1.49 | 189.7 | 66.21 | 135 | 6.238 | 0.714 | 11.44 | 936.785.57 | |
| 75 | 7.342 | 0.134 | 1.79 | 221.6 | 66.74 | 140 | 6.131 | 0.806 | 13.14 | 1042.786.89 | |
| 80 | 7.262 | 0.156 | 2.15 | 253.6 | 68.02 | 145 | 6.015 | 0.909 | 15.11 | 1160.688.13 | |
| 85 | 7.178 | 0.182 | 2.54 | 289.7 | 69.66 | 150 | 5.891 | 1.022 | 17.33 | 1288.489.39 | |
| 90 | 7.108 | 0.212 | 2.98 | 330.2 | 71.19 | 155 | 5.764 | 1.145 | 19.88 | 1427.490.53 | |
| 95 | 7.009 | 0.245 | 3.50 | 373.4 | 72.87 | 160 | 5.679 | 1.333 | 23.47 | 1638.791.93 | |

FANS.

The use of hot air is a decided advantage on estates where there is frequently a difficulty in obtaining a wither, as although the flavour (if any in the leaf) is not quite so marked when hot air is used, the advantage of getting a wither before other putrefactive changes commence is obvious.

The best results with good medium jat leaf are obtainable with a 60 to 54 % wither, though with some leaf an excellent feel is obtained with a loss of 35 % moisture. (Bamber.)

The length of time that leaf should be withering can only be regulated by using artificial means of drying.

Messrs. Davidson & Co.'s Sirocco centrifugal fans have been worked with great success as the following table overleaf will show :—

LEAF WITHERING.—Results of Experiments with Sirocco Fans on Nise Estates.

The best results were obtained by passing through the lofts, over the leaf, a cool air 80°. (100° being the full saturation.) In these tests no hot air was admitted from the dryers.

| Estate. | District. | Elevation in feet above Sea level. | Weather Conditions. | Condition of Leaf on arrival at Factory. | Weight of Green Leaf in lbs. | Time required to wither leaf in hours. | Class of percentage of wither. | Number and Description of Fans. |
|---------|---------------|------------------------------------|-------------------------|--|------------------------------|--|--------------------------------|---------------------------------|
| 1 | Kelani Valley | 100 | rain at intervals | covered with surface moisture | 2,840 | 15 | Good, soft and even 50% | Two 30 in. sirocco cased Fans |
| 2 | Kelani Valley | 900 | raining all day & night | sopping wet | 2,774 | 10 | even wither 35% | Two 30 in. sirocco Fans |
| 3 | Morowakorle | 2,000 | raining all the time | very wet | 4,262 | 15 | good wither 52% | Four 30 in. sirocco Fans |
| 4 | Ratanapura | 1,500 | showery | slightly moist | 3,416 | 7½ | rather underwithered 67% | Two 60 in. sirocco Fans |
| 5 | Agapattana | 5,000 | thick mist | covered with surface moisture | 3,736 | 10½ | 54% good even wither | Two 35 in. sirocco cased Fans |
| 6 | Bogawantalawa | 4,500 | showery | slightly moist | 1,740 | 12 | 50% soft even wither | Two 30 in. sirocco cased Fans |
| 7 | Lindula | 4,500 | raining all the time | sopping wet | 2,344 | 18 | soft & clammy, very even | Two 35 in. sirocco Fans. |
| 8 | Passara | 3,000 | raining | very wet | 2,968 | 13½ | good soft wither 52% | Two 35 in. sirocco cased Fans |
| 9 | Udapusnellawa | 5,000 | very wet | covered with surface moisture | 3,000 | 17 | 57% | Two 35 in. cased Fans. |

TEAS FOR AMERICA.

Value of teas laid down in London in pence multiplied by $2\frac{1}{2}$ = laying down price in New York in cents of dollar.

Trade require chiefly 40 lbs. to 50 lbs. packages.

An invoice certified by the American Consul is obligatory for all shipments of tea in excess of Rs. 300 in value.

AVERAGE COST OF PACKAGES.

It is not possible to give any fixed rate under this heading. The average cost at beginning of 1917 may be taken as $3\frac{1}{2}$ cts.

PACKING MATERIAL FOR 100 CHESTS OF TEA.

| | | | | |
|--|------|------|------|---|
| Lead. —84 in. x 22 in., in boxes of 2 cwt. 4½ oz. | | | | |
| lead, 84 sheets. (1½ sheets to each chest) | cwt. | qrs. | lbs. | |
| 100 chests = 231 boxes | ... | 4 | 0 | 2 |
| 20 cwt., nett of lead = 21 cwt. 1 qr. gross | | | | |
| Solder. —44 sticks in a box of 28 lbs. 1 stick | | | | |
| = 8 chests, 352 chests to a box of 28 lbs., | | | | |
| 100 chests | ... | 0 | 0 | 8 |
| To make solder 3 lbs. lead to 1 lb. block tin. | | | | |
| Soldering Fluid. —1 quart Baker's fluid = 300 | | | | |
| chests. 100 chests $\frac{1}{3}$ of a quart | | | | |
| Nails. —1½ in. No. 8,800 to 100 chests (446 to 1 lb.) | | | | |
| | 0 | 0 | 13½ | |
| ¾ in. No. 3,600 to a 100 chest (442 to 1 lb.) | | | | |
| | 0 | 0 | 9 | |
| Hoop Iron. —½ in. 24 B. W. G. 2,500 feet = 1 cwt. | | | | |
| 10 chests = 1,300 feet | ... | 0 | 2 | 4 |

BRITISH TEA SEASONS.**At Colombo and Calcutta.**

The Ceylon Season begins on the 1st January and the India Season on the 1st April each year.

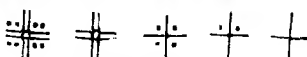
LONDON BROKERS' INSPECTION MARKS.

To Denote Quality, Appearance and Condition of Teas.

Ordinary Marks used for Ceylon Teas:—

 $\sqrt{\alpha}$ = *superfine* $\sqrt{\text{—}}$ = *fine* $\sqrt{\alpha}$ = *fine* $\sqrt{\text{—}}$ = *good*

Fancy Marks for very fine teas:—



ROLLING TEA.

Hard rolling gives strength, but will show little tip. For a hard wither a hard roll is necessary. Hard rolling destroys flavour of small leaf, and improves strength of large.

Light rolling is preferable for fancy teas.

If sap comes too quickly in rolling it shews leaf requires more withering.

Roll should be sifted through a breaker and coarse leaf re-rolled.

DRYING TEA.

Drying in the sun gives a black and tippy tea.

Tea dried in the sun cups out with a metallic taste; colouring and softening go on rapidly over slow fires, and are checked by all-aglow fires.

Quick firing gives a brisker tea than slow firing. The roll spread too thickly on firing trays gets stewed and dull.

Final firing develops "nose" or aroma.

Drying in the sun before packing completely desiccates the tea, but gives it a peculiar flavour.

TEA TASTING.—Tea Planters' Vade Mecum.

In valuing tea the following characteristics should be noted:—

1. *Liquor*.—Whether strong, rasping, pungent, brisk, flavoury, full, thick, malty, dark, or wanting in strength, dull, insipid, thin, burnt, soft—judged by taste.

2. *Infusion*.—Whether bright or dull colour, or mixed with green, or any dark or burnt leaves, over—or under-fermented—judged by sight.

3. *Leaf*.—Its make and appearance, whether black, wiry, even, regular, good, well twisted, flaky, bold, tippy or grey, dusty, little or badly twisted, open twisted, irregular, wanting in tips, &c.—judged by sight.

4. Any distinctive characteristic it may possess, viz.: “nose” strong rich scent, or musty, burnt, highly fired, dull, &c.—judged by smell.

HOW TO INFUSE CEYLON TEA.—(Bamber.)

To obtain the Maximum amount of Aroma and Theine and minimum percentage of Tannin.

1. See that the water to be used is fresh.
2. Bring quickly to the boil, and do not allow all air to be expelled by prolonged stewing over the fire.
3. Heat the tea pot with a little boiling water or by standing near the fire.
4. Put the required quantity of tea into the hot tea pot just before water boils and keep hot.
5. Pour on the hot water immediately it boils, *i.e.* when the steam issues from the kettle with force.
6. Cover the tea pot, and keep hot either on a stove, or by means of a cosy.
7. Infuse the leaf for five minutes, and then either drink at once, or pour the infusion into a second heated tea pot: or a tea pot with an internal infuser can be used with advantage, the infused leaf being removed at the end of five minutes.
8. Where an ordinary tea pot is used, stirring for a moment before use will improve the colour of the infusion, but the pot must be quickly re-covered to prevent loss of the aroma.
9. On no account should a second brew be obtained from the same leaves.

TO USERS OF TEA.

Keep the tea protected from the atmosphere or damp.

Very “hard” water makes thin infusion.

Softening water, by adding soda, spoils the tea aroma, though it darkens the liquor.

One pound of Ceylon tea will produce 7½ gallons of liquid: while one pound of China will only produce 5 gallons of liquid, of a like depth of colour and fulness of flavour.

NITROGEN IN TEA.

Perfectly dried tea at 200° Fahr:

| | | |
|--------------------|-----|----------------|
| In 100 parts Pekoe | — | 6.58 Nitrogen. |
| „ Gunpowder | ... | 6.62 „ |
| „ Souchong | ... | 6.15 „ |
| „ Assam | ... | 5.10 „ |

In 1,000 lbs. Ceylon teas as sold there are about the following:—

| | | | |
|----------|-------------|-----------------|------------|
| Nitrogen | ... 45 lbs. | Phosphoric acid | ... 8 lbs. |
| Potash | ... 22 „ | Lime | ... 2½ „ |

PACKING AND WEIGHING TEA.

For Capacity of C. G. R. Railway Trucks see Rubber Section.

Packages should be made of well seasoned wood, with triangular battens in the angles nailed to the package from the inside with nails of sufficient length to enable them to be clenched on the outside; this greatly strengthens the package. A lining of good stout tea lead is necessary.

As freight is charged on the measurement, and buyers refuse all slack-packs, except at a reduction in price, it is important to well fill all packages, the tea being closely filled in but not crushed.

Factory Bulked Teas.—In the case of Estate bulked teas, care should be taken that the empty packages of any break should not vary more than 2 lbs. in weight. If the variation is more than this all the packages are turned out for the purpose of taking actual tares. Great attention should be paid to the packing as (even after the most careful bulking) irregularity in the appearance of the leaf due to this having been unevenly done, may necessitate rebulking in London.

Marks on Chest.—Nothing is wanted or is of any service beyond (1st) Garden Mark; (2nd) Description of Tea; (3rd) Garden Numbers; Gross, Tare, and Net, are not of use.

Gross.—In taking the gross weight of packages exceeding 28 lbs., the Customs deduct all ounces over the even pound. The gross weights of 127 lbs. up to 127 lbs. 15 ozs. are taken as 127 lbs.

Tare.—In weighing the empty package for tare, fractions of less than half a pound are ignored, but a half pound or over is taken as a full pound, thus a tare of 28 lbs. 7 ozs. is taken as 28 lbs. one of 28 lbs. 8 ozs. or over as 29 lbs.

Net.—The net contents of the chest are never weighed, but are arrived at thus:—

| | | |
|----------------------------------|-----|------------|
| Shooks. —100 chests weigh | ... | 2,340 lbs. |
| 100 $\frac{1}{2}$ chests weigh | ... | 1,500 „ |
| 100 $\frac{1}{4}$ chests weigh | ... | 850 „ |

| | | |
|---------------------------|-----------|-----------------------------------|
| | lbs. ozs. | lbs. |
| An actual gross weight of | ... 127 6 | gives a Customs weight of ... 127 |
| Do. tare do | ... 27 5 | do. do. ... 27 |
| Giving a net of | ... 100 1 | or do. do. ... 100 |

The gross weight should in all cases amount to a few ounces over the even pound to guard against loss in transit. If the gross were weighed to the even pound in the factory and there were a loss on the voyage of only one ounce, this would mean a loss of one pound in London. Thus a factory gross of 127 lbs. losing one ounce in transit would give an actual weight in London of 126 lbs. 15 ozs. and be taken by the Customs as 126 lbs.

The tare (that is the weight of the empty package including lid, nails and hoop iron) should weigh a few ounces below the half pound.

The following are instances of how teas should turn out in London so as to avoid heavy loss:—

| | | | |
|----------|-----------|---------------------|--|
| | lbs. ozs. | | lbs. |
| Gross... | 127 4 | = Customs weight... | 127 |
| Tare ... | 27 4 „ | „ | ... 27 |
| Net ... | 100 0 „ | „ | ... 100 loss 1 lb. that is draft only. |

Or:—

| | | | |
|----------|---------|---------------------|---|
| Gross... | 127 5 | = Customs weight... | 127 |
| Tare ... | 27 3 „ | „ | ... 27 |
| Net ... | 100 2 „ | „ | ... 100 loss including draft 1 lb. 2 ozs. |

And not in the following manner where the loss would be heavy:—

| | | | |
|----------|---------|---------------------|---|
| Gross... | 127 13 | = Customs weight... | 127 |
| Tare ... | 27 9 „ | „ | ... 28 |
| Net ... | 100 4 „ | „ | ... 99 loss including draft 2 lbs. 6 ozs. |

Or again:—

| | | | |
|----------|---------|---------------------|---|
| Gross... | 127 15 | = Customs weight... | 127 |
| Tare ... | 27 8 „ | „ | ... 28 |
| Net ... | 100 7 „ | „ | ... 99 loss including draft 2 lbs. 7 ozs. |

Draft of 1 lb. per package on all packages grossing 29 lbs. and upwards is allowed to the buyer.

SIZE OF BREAKS.

London.—All breaks of smaller quantity than :—

| | |
|----------------|--|
| 18 full chests | } are considered small and sold at the conclusion of the sales |
| 24 half chests | |
| 30 boxes | |

COLOMBO SALES.

1,000 lbs. and over = large breaks. Under 1,000 lbs. = small breaks.

RUSSIAN TEAS.

The Russian Empire imports four kinds in the following order, viz., China, Indian, Ceylon and Java teas.

The trade is both wholesale and retail, both blended and unblended ; the Russians, as a rule, prefer blended tea, the percentage of China tea generally being the greater.

Retailers sell tea in small packets varying from 1 Russian pound to $\frac{1}{2}$ lb. called in Russian Solotnik. The price of a pound packet is from Rls. 1/40 to Roubles 4. When packets are being prepared in factories a supervising Government official is always present.

Tea buyers in Ceylon, for shipment to Odessa, generally ship original packages baled with an extra hoop iron. Casing in hessian is rare, and only when the boxes are considered insufficiently strong. Momie boxes are much preferable to the native boxes.

All teas for Moscow *via* Vladivostock and Nicolaevsk are re-packed in patent Veneer boxes of one of the better known kinds, viz., Venestas, Transitos, Veerpacks, Veneers, &c. Venestas are the most preferred, being stronger, though more expensive. Packing paper is occasionally used as a first packet, which is then again packeted in lead, very often lead only is used, there being no special rule in Russia regarding this.

The reason for re-packing teas in Venestas is to save expense in rail freight, patent boxes have a bigger capacity, and are lighter in weight than the mummies or natives. The most popular size of Venestas used for shipments is 20 in. x 20 in. x 24 in., holding about 110 to 125 English pounds of leaf tea. Patent boxes do not need to be cased in hessian.

Some Russian buyers, owing to the difference in freight, use water-proof tarpaulin bags for repacking very cheap grades of leaf teas, dust and fannings for shipments to Hankow, and these bags are returned to Colombo many times for further use.

COLOMBO TEA SALES.**CONDITIONS.**

The highest bidder to be the purchaser; and any dispute that may arise to be settled by the Selling Broker, who is not to declare the name of the buyer until after the lot is knocked down, unless, in his opinion, there shall be any uncertainty as to the bidder,

The seller of the tea or any agent employed by him to have the right of bidding.

2.—All teas to be sold by the lot at so much per pound free of any duty levied under the Medical Wants Ordinance No. 9 of 1912, which duty, if any, shall be payable by the Seller. No less advance than ONE CENT per lb. to be made on any previous bid. When a bid is registered by the Selling Broker the bidder shall have the right to claim the tea at any advance in price, such bids to be binding until 1 p.m. of the day following Sale.

3.—A deposit of ten per cent. to be made, if required, at the moment the lot is knocked down, otherwise it will be put up again and re-sold immediately.

4.—All teas shall be paid for on catalogued weights (less 4 lbs. sample allowance on large breaks, and 3 lbs. on small breaks) on or before prompt day which shall be five days from date of Sale, Sundays and Bank Holidays excepted. On receipt of payment the Seller shall issue a delivery order in favour of the Buyer who shall thereupon take delivery at Seller's stores. Should payment not be made before noon on prompt day Monday, 23rd March, the Seller shall have the right, on giving notice in writing to the Buyer, to re-sell the lot or lots at the risk of the buyer, who shall be liable for any loss resulting from such re-sale. The tea notwithstanding the fact that it may have already been paid for, shall be at Seller's risk to the amount of the contract value only, for two clear working days after prompt day, unless previously delivered, and thereafter at Buyer's risk, except in the case of any dispute or disagreement arising, in which event it shall remain at Seller's risk pending settlement of such dispute or disagreement.

5.—If required by the purchaser two separate delivery orders shall be granted for any parcel of tea consisting of or over 20 chests or 35 half chests.

6.—The selling Broker shall open, inspect and sample the Tea. The sample in the case of a large break shall consist of 4 lbs. and a small break 3 lbs. Four packages of a large break and three packages of a small break shall be sampled, 1 lb. exactly being drawn from each

package. Where there are only two packages $1\frac{1}{2}$ lbs. shall be drawn from each package. All packages sampled shall be marked accordingly by prominently stencilling the letter "S" thereon. Provided the samples so drawn are found to be similar, and of equal quality, such sampling as aforesaid shall be considered sufficient, but should there be any variation in quality every package shall be sampled, an equal quantity of tea being drawn from each package. No sampling whatsoever shall be done unless the entire lot shall have arrived at seller's stores. Catalogues shall state whether or not teas are bulked and hooped, and in the case of teas not bulked every package shall be sampled, an equal quantity being drawn from each package.

7.—All teas offered for sale shall be packed in good merchantable packages and the selling Broker shall declare in his catalogue whether such packages are "momi," "native wood," "patent," or "metal." All teas in packages over 28 lbs gross packed with lead under 4 oz. shall be so declared.

8.—(a) All packages shall have the gross and net weights marked thereon previous to being offered for sale, and in the event of a shortage in weight being proved to the satisfaction of the Seller he shall be liable or such shortage, and also for the cost of weighing which shall not exceed $12\frac{1}{2}$ cents per package.

(b) All objections as to quality, description, packing, or weights must be made on or before the tenth day after date of Sale, Sundays and Bank Holidays excepted.

9.—Brokers Buying or Selling Tea shall declare in writing their principals immediately after the Sale, otherwise they themselves shall be held responsible as Principals.

10.—Should any dispute or disagreement arise between Buyer and Seller the same shall be referred to the arbitration of one arbitrator to be appointed by both parties, or, if the parties cannot agree as to an arbitrator to the arbitration of two arbitrators, one to be appointed by each party. The arbitrator shall, before proceeding with the business of the arbitration appoint an umpire, to the arbitration of whom shall be referred all questions on which the arbitrators are unable to agree. The award of such arbitrator, arbitrators, or umpire (as the case may be) shall be final, conclusive and binding on all parties. If either party shall refuse or neglect to appoint an arbitrator within three days after the other party shall have appointed an arbitrator on his part, and shall have served or posted under registered cover written notice requiring him to make such appointment, then the arbitrator appointed as aforesaid shall, at the request of the party appointing him, proceed to arbitrate

on the matter in dispute as if he were an arbitrator appointed by both parties for that purpose.

N.B.—Additions or alterations to the foregoing Rules and/or Bye-Laws may be made from time to time as occasion arises at a General Meeting of the Colombo Tea Traders' Association to be called for such purpose in accordance with the rules of the Association.

INDIAN AND CEYLON TEAS.

LONDON CONDITIONS OF SALE.

1. The highest bidder to be the purchaser, and any dispute that may arise to be settled by the Selling Broker.

2. Brokers must declare, in writing, their Principals (to be approved by the Selling Brokers) within 24 hours after the purchase, or be held responsible, and those who may execute orders at this sale for parties not resident in London shall produce a known Agent here, who shall undertake to complete the contract; in failure of which the Broker so buying shall be held responsible; and if any Broker shall purchase for any person or persons under age, he shall be held responsible. In the case of teas sold for cash, the buying Broker to be held responsible.

3. Every person who shall be declared the highest bidder shall pay to the Selling Broker a deposit of not exceeding £1 per chest at the time of sale, if demanded, or on the Saturday following the day of sale, or on the delivery of the weight notes: the remainder of the purchase money to be paid within three calendar months. Interest at the rate of £5 per cent. per annum will be allowed on payment of the deposit, and on the remainder from the day of payment to the prompt day. The tea to be taken by the buyers at the Customs' weight, and to be delivered in bond, with Customs' tare. Draft as usual. The "Customs' weight" shall mean the full weight of the packages as landed, and shall include the odd ounces which the packages may weigh in excess of the Customs inscribed weight; the only tea which may be taken from the packages (*without returns*) before delivering them to the buyer, shall be that drawn for Merchants' samples and for necessary inspecting purposes.

4. These teas have been weighed, inspected, bulked (in the country of production or London) and tared, and will be reweighed, papered, and leaded down, by the evening of the day after the day of sale. All packages will be nailed down within six days. Delivery will be given on the day after the day of sale, and up to the delivery of weight notes, on notice being given (in writing) the day before it is required, to the Selling Broker and Warehouse Keeper. The buyer to have the option of refusing any packages as to which the above conditions have not been complied

with. Three clear working days are to be allowed for delivery of weight notes. The buyer to have the option of refusing to accept any lot or lots for which weight notes have not been delivered by the evening of the third day, by giving a written notice to that effect to the Selling Broker on the following morning, if, on application, he cannot then obtain them. Missing packages, if equal to bulk, and not more than 5 per cent., are exempted from this condition, and are to be taken by the buyer at the original price and prompt if tendered within fourteen working days from date of contract.

5. No claim for difference in bulk from show or selling sample will be entertained unless notified in writing to the Selling Broker within three working days from the day of sale. No allowance will be made on account of any damage, rubbish, false package, or unequal goodness, found, or alleged to be found, after the goods have been taken from the warehouses.

6. All tea sold at this sale to be at the risk of the sellers until the prompt day, unless paid for previously, but only to the extent of market value. In the event of non-delivery by loss from fire, the contract for such portion to be void, and the deposit paid to be returned. Rent to commence from the prompt day.

7. Lot money to the Selling Broker as usual.

8. If any buyer shall fail to comply with the above conditions, the vendors shall be at liberty to resell the teas either by public or private sale, the deficiency, if any, with interest on money, from the prompt day, warehouse rent, and all other charges and damages of every kind, to be chargeable to such defaulter, and be recoverable against him at law.

9. Any dispute that may arise concerning any parcel sold in this Catalogue to be referred to two arbitrators (who must be members of either the Indian Tea Association, the Ceylon Association in London, the Tea Buyers' Association, or of the Tea Brokers' Association of London) to be mutually chosen, and who are to appoint an umpire, if necessary, the loser to pay the fees (two guineas) to each arbitrator, and two guineas to the umpire if called in for all arbitrations, including attendance at the warehouses if necessary.

SALE OF FOOD AND DRUGS ACT. (38 & 39 Vict. Ch. 63.)

SPECIAL PROVISION AS TO TEA.

Tea to be Examined by the Customs on Importation.

All tea imported as merchandise into and landed at any port in Great Britain or Ireland shall be subject to examination by

persons to be appointed by the Commissioners of Customs, subject to the approval of the Treasury, for the inspection and analysis thereof, for which purpose samples may, when deemed necessary by such inspectors, be taken and with all convenient speed be examined by the analysts to be so appointed; and if upon such analysis the same shall be found to be mixed with other substances or exhausted tea, the same shall not be delivered unless with the sanction of the said Commissioners, and on such terms and conditions as they shall see fit to direct, either for home consumption or for use as ships stores or for exportation: but if on such inspection and analysis it shall appear that such tea is in the opinion of the analyst unfit for human food, the same shall be forfeited and destroyed or otherwise disposed of in such manner as the said Commissioners may direct.

INTERPRETATION OF ACT.

Tea to which the term "exhausted" is applied in this Act shall mean and include any tea which has been deprived of its proper quality, strength, or virtue by steeping, infusion, decoction, or other means.

MEMORANDUM AS TO LANDING, INSPECTION, SAMPLING, BULKING AND SELLING OF TEAS IN LONDON.

As soon as possible after the tea is landed from the ship on to the quay in the docks and placed under cover of the sheds the different marks are sorted out and conveyed in locked vans or by river lighters to some up-town warehouse either belonging to the Dock Company or a private individual. In the case of Commercial Road Warehouse, the teas are taken up by train from Tilbury Docks.

Arrived at the warehouse, the packages are numbered and marked with the rotation number of the ship and year of import, they are then weighed gross in the presence of a Custom House Officer and one of the clerks of the warehouse, each one entering the weight in his book.

Inspection:—The above operation completed the packages have a portion of the top opened, and on the arrival of the Selling Broker's Inspector a piece of the lead is cut, and are then laid down in rows, so as to be easily accessible. In the case of inspecting by boring there is a small hole bored in the package and after inspection the hole is plugged and a piece of tin nailed over. A handful of tea is then taken or drawn with a boring iron from each package by one of the warehousemen and placed separately on trays; these trays are then brought to the Selling Broker's Inspector, who sits in a light part of the warehouse and examines separately the handful taken from each chest. By this means he sees any

difference which may appear in the leaves either [as regards size and colour. He also carefully smells each sample to be sure that there is no taint of damage. If he finds no variation in quality, he passes the break, and there is no occasion to bulk the tea. An average tare can then be taken and tea can be sold without bulking.

Should there be a variation in the appearance of the teas sufficient to necessitate bulking, the Inspector will then, with the permission of his principal, give an order for the bulking of such parcel as may require it.

TEA TARING REGULATIONS.

General Order 42/1900

Custom House, London, May 28th.

1. The Board direct that on and after June 1st, 1900, in taring whether separately or for averaging purposes, any package of tea of which the gross landing weight was more than 28 lbs. the weight of the empty packages be ascertained as follows:—

When the scales have been carefully balanced, a half-pound weight is to be placed in, or attached to, the weight scale. The weight of the package must then be taken to the pound only, the weight scale preponderating according to the usual practice in taring. The half pound weight placed in the scale is to be ignored in recording the tare.

2. The Board further direct that, for average taring, the number of packages for "tarers" prescribed by paragraph 61 of General Order 127/1892 be increased as follows, viz:—

When in a chop or bed, the number of packages of the same size and description of tea is—

| | |
|------------------------|----------------------------|
| 20 or less..... | 3 "tarers" to be taken and |
| from 21 to 60..... | 5 do |
| „ 61 to 120..... | 7 do |
| „ 121 to 400..... | 9 do |
| „ 401 to 700..... | 11 do |
| „ 701 and upwards..... | 13 do |

Two or more beds in one chop may be tared together on the foregoing scale.

3. Every package of tea bulked in the United Kingdom shall be separately tared.

General Order 102/1894 respecting taring of bulked teas, and the, as yet, suspended London Port Order 39/1899 are hereby cancelled.

By order of the Board.

DUTIES ON TEA ALL OVER THE WORLD.

Approximate duty in pence per English Pound.

| | | | | | |
|---|-----|-----|-----|--|-------------------------|
| Aden | ... | ... | ... | ... | Free. |
| Antigua | ... | ... | ... | ... | 7d. |
| Arabia | ... | ... | ... | ... | about 4½d. to 7d. |
| Argentine | ... | ... | ... | 4½d.—12 per cent. ad valorem. | |
| Australasia | ... | ... | ... | ... | See different Colonies. |
| Bahamas | ... | ... | ... | ... | 6d. |
| Barbados | ... | ... | ... | 3d.—20 per cent. ad valorem. | |
| Bermuda | ... | ... | ... | 6½ per cent. ad valorem. | |
| Belgium | ... | ... | ... | ... | Free. |
| Brazil | ... | ... | ... | 50 per cent. ad valorem. | |
| British East Africa | ... | ... | ... | 10 per cent. ad valorem. | |
| British Guiana | ... | ... | ... | ... | 8d. |
| British North Borneo | ... | ... | ... | ... | 1d. |
| British New Guinea | ... | ... | ... | ... | 2d. |
| Bulgaria | ... | ... | ... | 4½d.—14 per cent. ad valorem. | |
| Canada | ... | ... | ... | Imported direct from Country of production free. Also if purchased in bond in the United Kingdom. Otherwise 10 per cent. ad valorem. | |
| Cameroons | ... | ... | ... | 6 per cent. ad valorem. | |
| Cape Colony | ... | ... | ... | ... | 4d. |
| Ceylon | ... | ... | ... | ... | 4d. |
| Central America | ... | ... | ... | ... | Free. |
| Chili | ... | ... | ... | ... | 9d. |
| Cyprus | ... | ... | ... | ... | 4d. per oke* |
| Danish West India Islands | ... | ... | ... | 12½ per cent. ad valorem. | |
| Denmark | ... | ... | ... | ... | 4d. |
| Dominica | ... | ... | ... | ... | 8d. |
| Dominican Republic | ... | ... | ... | ... | 1s. 3d. |
| Ecuador | ... | ... | ... | ... | 2½d. |
| Egypt | ... | ... | ... | 7 per cent. ad valorem. | |
| Fiji | ... | ... | ... | ... | 6d. |
| Finland | ... | ... | ... | ... | 1s. 6d. |
| France | ... | ... | ... | 9d. toll. ½d. | |
| (Tea imported from Europe to France <i>entrepôts</i> to subject to a surtax of 0.16d.) | | | | | |
| French Oceania | ... | ... | ... | 8 per cent. ad valorem. | |
| Gambia | ... | ... | ... | 5 per cent. ad valorem. | |

* Oke = 2.8 British Standard lb.

DUTIES ON TEA ALL OVER THE WORLD. - (Contd.)

| | | | | |
|---------------------|-----|-----|-----|--|
| Gibraltar | ... | ... | ... | Free. |
| Gold Coast | ... | ... | ... | 4 per cent. ad valorem |
| Greece | ... | ... | ... | 1½d. |
| Grenada | ... | ... | ... | 6d. |
| Holland | ... | ... | ... | 2½d. |
| Honduras | ... | ... | ... | 2½d. |
| India | ... | ... | ... | 5 per cent. ad valorem. |
| Italy | ... | ... | ... | 11d. |
| Jamaica | ... | ... | ... | 1s. |
| Japan | ... | ... | ... | 25 per cent. ad valorem. |
| Java | ... | ... | ... | 6 per cent. ad valorem. |
| Kiauchou | ... | ... | ... | Free. |
| Korea | ... | ... | ... | 7½ per cent. ad valorem. |
| Lagos | ... | ... | ... | 1d. |
| Malta | ... | ... | ... | Free. |
| Mauritius | ... | ... | ... | about 3d. + 4 per cent. ad valorem. |
| Mexico | ... | ... | ... | 6d. |
| Montserrat | ... | ... | ... | 6d. |
| Morocco | ... | ... | ... | 10 per cent. ad valorem. |
| Natal | ... | ... | ... | 4d. |
| Newfoundland | ... | ... | ... | 33 per cent. ad valorem. |
| New Zealand | ... | ... | ... | 2d.† |
| New South Wales | ... | ... | ... | Free. |
| Nigeria | ... | ... | ... | 1d. |
| Norway | ... | ... | ... | 1s. |
| Norfolk Islands | ... | ... | ... | 3d. |
| Orange River Colony | ... | ... | ... | 4d. |
| Persia | ... | ... | ... | about 4½d. to 7d. |
| Peru | ... | ... | ... | 65 per cent. ad valorem and 10 per cent. |
| Portugal | ... | ... | ... | 2s. 0½d. |
| Portuguese India | ... | ... | ... | 5½d. |
| Queensland | ... | ... | ... | Free. |
| Roumania | ... | ... | ... | 3½d. and 4½d. excise. |

† Tea grown in British Dominions free except in packets not exceeding 1 lb. Other Tea 2d.

DUTIES ON TEA ALL OVER THE WORLD.—(Contd.)

| | | |
|---------------------------|--------------------------------------|-----------|
| Russia | Brick tea, black and green tea | 8d. |
| Do. other tea | | 1s. 11½d. |
| Samoa | 10 per cent. ad valorem. | |
| Seychelles | per kilo | 4d. |
| Sierra Leone | 10 per cent. ad valorem. | |
| Southern Nigeria | | 1d. |
| St. Helena | | Free. |
| South Africa | | 4d. |
| South Rhodesia | | 4d. |
| South Australia | | Free. |
| Spain | | 6½d. |
| Sweden | | 3d. |
| Switzerland | 1½d. to 1s. 10d. | |
| St. Lucia | | 6d. |
| St. Vincent | | 6d. |
| St. Christopher and Nevis | | 6d. |
| Straits Settlements | | Free. |
| St. Helena | | Free. |
| Tasmania | | Free. |
| Tonga | 10 per cent. ad valorem. | |
| Togoland | 4 per cent. ad valorem. | |
| Transvaal | | 4d. |
| Trinidad and Tobago | | 6d. |
| Turks and Caicos Islands | | 6d. |
| United Kingdom | | 5d. |
| United States of America | | Free. |
| Uganda | 10 per cent. ad valorem. | |
| Uruguay | 5½d. + 5 per cent. ad valorem. | |
| Venezuela | about 6d. + 30 per cent. ad valorem. | |
| Victoria | | Free. |
| Virgin Islands | | 3d. |
| West Australia | | Free. |
| Zanzibar | | 6d. |

(The Customs and its Cognate Institutions by H. E. de Kretser.)

* The following duties are also leviable:—Tea imported over the Siberian frontier and the frontier of the Steppes:—

| | |
|--|----------|
| Black (Baicha) tea, flower tea, green, yellow tea imported across the frontiers of the Steppes, Irkutsk and the Amur | 1s. 4d. |
| Other black, green, or yellow tea | 1s. 1½d. |
| Brick Tea | 2½d. |

Tea in tablets, if bearing the marks of Russian Manufacturers on each tablet ... 10d.

OCEAN FREIGHTS ON TEA.

1 Shipping Ton = 50 cubic feet.

= 917 lbs. of Tea in ordinary packages.

Exchange per lb. of Tea.

| Rate per ton. | 1/5d. Cents. | 1/4 $\frac{1}{2}$ d. Cents. | 1/4d. Cents. | 1/3 $\frac{1}{2}$ d. Cents. | 1/3d. Cents. |
|------------------|-----------------|--------------------------------|-----------------|--------------------------------|-----------------|
| 20/ | 1·54 | 1·59 | 1·64 | 1·69 | 1·74 |
| 22/6 | 1·73 | 1·79 | 1·83 | 1·90 | 1·95 |
| 25/ | 1·92 | 1·98 | 2·04 | 2·11 | 2·17 |
| 27/6 | 2·11 | 2·19 | 2·24 | 2·31 | 2·39 |
| 30/ | 2·31 | 2·38 | 2·45 | 2·52 | 2·61 |
| 32/6 | 2·50 | 2·59 | 2·65 | 2·74 | 2·82 |
| 35/ | 2·69 | 2·78 | 2·85 | 2·94 | 3·04 |
| 37/6 | 2·88 | 2·99 | 3·06 | 3·14 | 3·26 |
| 40/ | 3·08 | 3·18 | 3·27 | 3·36 | 3·48 |
| 42/6 | 3·27 | 3·39 | 3·47 | 3·58 | 3·69 |
| 45/ | 3·46 | 3·58 | 3·67 | 3·78 | 3·91 |
| 47/6 | 3·65 | 3·79 | 3·88 | 4·00 | 4·13 |
| 50/0 | 3·85 | 3·98 | 4·08 | 4·21 | 4·35 |
| 52/6 | 4·04 | 4·19 | 4·28 | 4·41 | 4·56 |
| 55/ | 4·23 | 4·38 | 4·49 | 4·62 | 4·78 |
| 57/6 | 4·42 | 4·59 | 4·69 | 4·83 | 5·00 |
| 60/ | 4·62 | 4·78 | 4·90 | 5·04 | 5·23 |

Note.—There would be a saving of ten per cent. on above if
 “Venesta” packages were used.



FOREWORD.

THE preparation of another edition of this invaluable book takes place under the shadow of the Great War, and it is probable that of the many agricultural enterprises of the Island none have felt the effect of the war so heavily as has the Coconut Industry. In pre-war days, copra freight stood at 50s. 0d. per ton and space was always available. Today 408s. 4d. per ton is charged, and space for copra (which comes under the head of rough cargo) is hard to obtain. The price of copra has consequently dropped from Rs. 80—Rs. 90 to Rs. 35—Rs. 40 per candy, and the extra shipping charges knock off about Rs. 35 per candy of the *nett* profits. No one grudges the war tax which is equivalent to a little more than Rs. 5 per acre.

Other branches of the industry have been similarly affected.

At the same time, there is satisfaction in the knowledge that, as on well-managed estates, the total cost of production is about Rs. 28 per candy, the present prices can fall a little way yet before estates are working at a loss. In days to come, when war shall be no more, it is anticipated by many that the Coconut Industry will enjoy a spell of prosperity superior to any of its previous records.

NOTES.

COCONUT CULTIVATION.

COCONUT CULTIVATION IN CEYLON.

SELECTION OF SEED NUTS.

One would naturally suppose that the bigger the nut as picked in the husk, so will it contain the best kernel. Such is not always the case by any means, as it often happens that the largest husk is found to contain a very small nut, while a good ordinary one will have a very fine nut when husked. My experience tells me that it is always best to find out an estate well known to give large, or, rather I should say, heavy nuts such as take from 900 to 1,100 to a candy of copra. It often happens that a large nut when shelled produces a very thin kernel. However one cannot go wrong in picking out an estate well known to produce the best nuts. The rounder the nut is in husk the better will it be for selecting for putting into the nursery; long husks seldom contain large nuts. There is a great divergence of opinion as to the placing of the nut in the nursery. Some planters of great experience recommend placing it on its side, which is its natural position, while many others prefer to place it with the germ end upwards. If the district is a dry one, care should be taken in selecting a site for the nursery to have it near water if possible, as watering should be done at least two or three times a week. The nuts should be placed at about 2 ft. by 2 ft. apart in the nursery, the soil being dug out to a depth of, say, 2 feet; all jungle roots and stones being carefully removed, and a little sea sand should be mixed with the soil, so as to prevent the ravages of white ants, or failing that, a little salt or wood ashes. A light shade should cover the beds.

TRANSPLANTING.

This should be very carefully done, so as to cause as little injury as possible to the roots. The plants should be carefully placed in large baskets capable of holding 3 or 4 and carried to the field. The hole, which should be at least 2½ ft. by 2½ ft. wide by 3 ft. deep, with say 65 to the acre, should have at least 1 foot of first-rate virgin soil in the bottom. It is seldom that two plants are the same in growth, but the great thing to be desired is a tree with its collar as near the ground as possible. It is a very common thing to see trees with collars fully 3 ft. above the ground, shewing an immense number of root sprouts yearning for soil to feed on, and if banked up well with soil all these sprouts would undoubtedly become good healthy roots. When practicable, in opening a new nut

clearing the nursery should have a clear year's start, that is, provided well-grown plants cannot be secured from a neighbouring estate. This is an old-fashioned theory, modern knowledge is in favour of pulling out grub and young plants. A nursery too can be fenced and made quite secure against the depredations of deer, porcupines, and cattle, the great enemies to plantations of all kinds.

CULTIVATION.

There is no tree more grateful for kind treatment than the coconut, which, save in some few districts, until lately it never got. I would divide cultivation into six headings, viz. :—Tilling, Manuring, Mulching, Weeding, Ploughing, Propping.

TILLING OR PLOUGHING.

It is a well-known fact that under ordinary meteorological conditions nut gardens where practically no cultivation has been done, can be made to produce at least 50 per cent. more crop with judicious digging or ploughing all over, say, every two years.

MANURING.

Even a small average yield per tree pre-supposes the presence of certain amounts of available nitrogen, phosphoric acid and potash as are far in excess of the power of most soil to supply. These available ingredients must therefore be supplied by the planter if he wants to get the best return from his trees.

Coconuts growing near human dwellings are provided with the necessary fertilising ingredients through the waste and sewage from the houses. The splendid condition of such trees on otherwise poor soil and the phenomenal crops obtained, clearly prove the necessity of available plant-food.

The special advantage of artificial fertilisers in times of drought is well-known.

Nitrogen has at all times and with right been accorded first place in the consideration of soil fertility. Not only does it deserve this position from an economical point of view, but also because it is the ingredient which is principally responsible for vigorous growth of the tree itself, and its foliage. It is farther contained in large quantities in the constituent parts of the nut. Nitrogen is the most expensive of all ingredients, and the cost of manure mixtures can gradually be reduced if care is taken to incorporate with the soil the husks, the fallen leaves and green manures.

Phosphoric acid stimulates the setting of flowers and should be present in good proportion to enable the roots to readily absorb this ingredient. It is profitably given in excess of actual contents in crop, as not all of the phosphoric acid applied in fertilisers can be taken up by the coconut tree.

Potash is largely required by the coconut, and it should be supplied regularly in manure mixtures, as this element is necessary for the tree's life and development as well as for the production of large crops.

Lime, whilst affording no food to the plant, plays an important part in liberating the dormant food ingredients of the soil. Micro-organisms, as already seen, are responsible for liberating nitrogen. Soils with an acid tendency are very much improved by an application of lime, the latter providing a base for the organic acids formed by fermentation of the vegetable matter. Lime liberates phosphoric acid and renders potash available to the roots.

WEEDING.

It has been proved, beyond all doubt, that grass should not be encouraged on coconut estates, and that the yield per tree in grass grown areas is much below that of palms growing in clean weeded land, the difference being as much as 20 nuts per tree.

An ideal condition to aim at is to keep the land clean weeded and to harrow it regularly keeping the soil loose and free and in a fine state of tilth. Occasionally, ploughing or digging, in the first instance, is advisable, to break up hard soil.

PROPPING.

The young trees for the first few years of bearing require to have their nut clusters carefully propped, or the stem may break, being too light to support the cluster's great weight.

HARVESTING.

There being 6 blossoms in the year, there are 6 crops or pickings, one every 2 months. Nearly all this work in Ceylon is done at so much per tree, for each crop, and care should be taken to make the men clean the head of the tree thoroughly, removing all dead branches and rubbish likely to harbour rats, etc. On most estates the nuts are carted to central depôts or to the copra kilns, where they must be allowed to wither from 3 weeks to a month before being ready for husking for copra drying, or for the desiccating mills. Nuts for domestic use are husked at once after picking, and despatched to the town markets, such being the best for curry.

DISPOSAL OF HARVEST.

There are several ways of doing this. Coconut dealers know to a day when an estate is picking, and these men, who as a rule don't own an acre of land, come round and offer to buy. Some estates sell at once, the buyer being allowed to copra them *on estate*, waiting till

they are sufficiently withered for that, or, for carting off to the desiccating mills, but nuts for mills must be at least a month from picking. Some estates will not sell their husks, preferring to keep them for mulching, etc., and in case of a dealer buying the crop, an arrangement must be come to with regard to this. When the nuts are ready, the copra drier generally husks on the estate, carting them away either to mills, or, to his own copra kiln. There is a small demand for the shells for latex cups, which will probably increase as more rubber estates come into bearing.

Work is very slack in fibre mills just now owing to the scarcity of freight and the price offered for husks at present hardly covers cost of carting. Many mills are working only 2 or 3 days a week.

DISEASES AND ENEMIES.

Trees are wonderfully free of disease of any kind just now. There was a great scare a few years ago, over the bleeding disease, but it came to nothing, the oldest natives declaring it was nothing new. Enemies we always have in wild beasts, cattle, bandicoots, and porcupines, all of which do a lot of damage to young clearings, which should be watched and all vacancies carefully supplied. Once the plants are beyond the reach of cattle, the latter do good by keeping down the tall grasses and jungle growths. I have known new clearings that were completely ruined by porcupines devouring every seed nut as soon as planted.

DESICCATING MILLS.

The most important factor for success of a coconut desiccating business is the selection of the locality in which to establish a factory or mill as (1) a plentiful supply of nuts must be assured. (2) Transport facilities by road, river or canal for nuts and desiccated coconut chests to be despatched must be satisfactory and reasonable in cost. (3) Labour plentiful. 4. Abundant supply of suitable quality water available. (5) Adequate fuel supply at hand. (6) Factory site well above flood-level. Having selected the most desirable site the buildings can be erected after building a high wall all round the premises with two gates, one being the nut and fuel entrance and the other at opposite end for despatch of produce. Nut stores, office and superintendent's bungalow should be at the first-named entrance. The nut stores should be of ample dimensions for the quantities to be handled and thief-proof, with plenty of

space for halting and unloading of carts as well as nut counting. The building next the nut stores should be the shed in which nuts are shelled, shaved and washed. No walls are necessary, but the floor should be of cement or closely laid fire bricks, or tiles, to resist the action of the coconut water. In the middle of this shed should be built a long trough of brick and cement, about 3 ft. by 3 ft. leading to where the disintegrators are situated. This trough should always be kept $\frac{2}{3}$ full of clean water, into which the pared nuts are thrown and washed by the shavers before they are disintegrated. The main factory should adjoin the shaving shed, and desiccators or driers so arranged that trollies can bring the grated nut from the disintegrators to the tray ends; furnaces of the driers being built outside the main building walls in order to keep the factory as free of smoke as possible. From the driers trolley lines should lead on to the sifting machines, and from thence to the packing room. For economical manufacture it is advisable to use the largest possible driers, and to arrange that nuts and grated nut have not to be carried backwards and forwards.

Drier chimneys should be of ample height to ensure adequate draught and to conduct smoke away far and high as possible. The despatching entrance should be near the packing room end. Assuming that an output of 2,000,000 lbs. desiccated coconut is contemplated annually, the following is an estimate of cost of machinery and buildings necessary to deal with this output:—

| | Rs. | c. |
|---|-------------------|-----------|
| Buildings:—Nut stores (iron roof, brick walls and floors) ... | 4,000 | 00 |
| Superintendent's bungalow ... | 5,000 | 00 |
| Office ... | 1,000 | 00 |
| Material stores and fuel house ... | 3,000 | 00 |
| Copra and paring stores ... | 3,000 | 00 |
| Tool-house and forge ... | 1,000 | 00 |
| Chopping and shaving shed (iron roof, and pillars, firebrick floors and trough) ... | 4,000 | 00 |
| Desiccating factory (iron roof H. iron structure work, brick walls 50 x 90) ... | 25,000 | 00 |
| Engine room ... | 2,000 | 00 |
| Packing room ... | 2,000 | 00 |
| Copra drying kiln ... | 2,000 | 00 |
| Carpenter's and box-maker's shed ... | 1,000 | 00 |
| | Rs. 53,000 | 00 |

MACHINERY FOR 2,000,000 OUTPUT.

| | | | Rs. | c. |
|---|-----|-----|--------|---------------|
| Engine (oil or suction gas 50 B. H. P.) | ... | ... | 20,000 | 00 |
| Eight double desiccators | ... | ... | 28,000 | 00 |
| Two disintegrators | ... | ... | 4,000 | 00 |
| Two sifters | ... | ... | 1,000 | 00 |
| Plummer blocks, shafting and brackets | ... | ... | 3,000 | 00 |
| Belting | ... | ... | 750 | 00 |
| Trolleys and lines or rails | ... | ... | 1,500 | 00 |
| Weighing machines | ... | ... | 500 | 00 |
| Electric light, plant and accumulators | ... | ... | 3,000 | 00 |
| Tools | ... | ... | 500 | 00 |
| Stocks of spare parts | ... | ... | 3,000 | 00 |
| 9 feet brick wall around premises... | ... | ... | 4,000 | 00 |
| | | | | <hr/> |
| | | | | Rs. 69,250 00 |

COCONUTS IN THE F. M. S.**ESTIMATE FOR OPENING UP COCONUT LAND.**

BY L. C. BROWN.

INSPECTOR OF COCONUT TREES; AGRICULTURAL DEPT., F.M.S.

I am indebted to Mr. Munro, Permatang Estate, Banting, an excellent authority on Coconut cultivation for assistance in compiling this Estimate, as prices of labour have been obtained from him as well as other Planters of experience in Quala Langat and Lower Perak and these figures I have worked out on a general average. I am aware that where Chinese labour is employed the expenses of weeding and cultivation are heavier, and some allowance may have to be made for this; but, generally speaking, the advantages and disadvantages by which there may be a saving or otherwise on labour in the various districts about counterbalance themselves, and therefore on the total expenditure there should not be much difference in cost.

I consider, therefore, as a whole the Estimate submitted may be taken as reliable one, perhaps rather on the liberal side, and easily capable of being worked upon if the management is carried out on sound and economical lines by any experienced Manager. At the same time I have not taken into account any unusual expenditure or what may be considered as an extravagant or unnecessary expense.

As regards returns I have raised the price of copra to \$8.50 per pikul (under the average rate that has been realised during the past three years), which figure I am of opinion (in view of future prospects) may be taken as a conservative one. On the other hand I have allowed as much as 240 nuts to the pikul up to the 7th year, that is to say while the trees are in partial bearing. My reason for so doing is that during this period the nuts are often found to be smaller and contain less meat than at a later stage. However from the 8th year onwards I have retained the same rate as in my previous Estimate, viz: 220 nuts to the pikul, as I believe this return can then be reasonably anticipated.

The expenditure on the Estate up to the 6th year works out a little under \$190 per acre, and after this period the Estate may be considered self-supporting. Of course over a larger area, say from 1,000 to 3,000 acres, the average cost will be materially less. Allowing therefore for any little difference of expense in the various districts it should not cost more than \$200 per acre in any locality to bring a Coconut Plantation into a remunerative condition.

ESTIMATE FOR OPENING UP AND BRINGING INTO BEARING 500 ACRES.

| | |
|--|-----------------|
| <i>Felling and Clearing at \$20 per acre</i> | \$10,000 |
| Draining at \$ 16 per acre | \$ 8,000 |
| Cost of Seed (35,000) seeds @ 8 cents each | \$ 2,800 |
| Fencing @ \$4 per acre | \$ 2,000 |
| Lining and Planting @ \$3 per acre | \$ 1,500 |
| Coolie Lines | \$ 1,500 |
| Tools | \$ 300 |
| Bungalow | \$ 1,500 |
| Stationery and Postage | \$ 100 |
| Medical | \$ 1,500 |
| Premium @ \$3 per acre | \$ 1,500 |
| Quit-rent @ \$1 | \$ 500 |
| Survey Fees | \$ 500 |
| Weeding, 1st 6 months at \$1½ per acre per month ... | \$ 4,500 |
| Contingencies | \$ 1,000 |
| Superintendence | \$ 3,600 |
| Total | \$40,000 |

2nd year. 3rd year. 4th year. 5th year. 6th year.

| | | | | | |
|--|----------|----------|----------|----------|----------|
| Picking, Curing and Transport ... | — | — | — | — | 2,400 |
| Supplying ... | 325 | — | — | — | — |
| Superintendence and Visiting Agent ... | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 |
| Weeding, Tilling and Forking ... | 6,000 | 6,000 | 3,600 | — | — |
| Weeding ... | — | — | — | 3,000 | 3,000 |
| Quit-rent ... | 500 | 500 | 500 | 500 | 1,000 |
| Draining ... | 375 | 375 | 375 | 375 | 375 |
| Medical and contingencies... | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Total... | \$14,000 | \$13,675 | \$11,275 | \$10,675 | \$13,575 |

7th year \$14,800. 8th year \$19,400. 9th year \$19,400

RETURNS.

| | |
|---|----------|
| 6th year 10 nuts per tree = 1,000 pikuls of copra at \$ 8-50 (240 nuts to pikul) ... | \$ 8,500 |
| 7th year 30 nuts per tree = 3,000 pikuls of copra at 8-50 (240 nuts to pikul) ... | \$25,000 |
| 8th year 50 nuts per tree = 5,650 pikuls of copra at 8-50 (220 nuts to pikul) ... | \$48,025 |
| 9th year 50 nuts per tree ... 6,560 pikuls of copra at 8-50 (220 nuts to pikul) ... | \$48,025 |

THE NEW COCONUT PEST.

I have no hesitation in saying that so far as "Beetles" are concerned, these insects seldom if ever attack or penetrate into the cabbage of a strong, healthy and well developed tree; in other words, a tree that has been carefully cultured has the power of resisting most pests.

The insect that does the damage is related to the so-called White Fly which ravages the citrus groves of Florida and, as far as I am aware, the pest has never made its appearance either in the Straits, Province Wellesley or the Federated Malay States.

The insect has been described by Mr. Quaintance of the Bureau of Entomology, United States Department of Agriculture as *Aleyrodicus destructor*. He states that the eggs which are very minute are laid on the under surface of the leaflets, usually on the young leaves, and soon after the eggs are hatched the young insect begins walking about on the underside of the leaf and, having located itself, it inserts its beak through the epidermis of the leaf and begins to suck the sap from the soft inside tissue; after becoming thus attached, the young insect seldom moves, unless disturbed, until it attains its full size. Shortly before emerging as a winged insect it stops feeding, but remains attached to the leaf. Though comparatively weak fliers, the danger of their passing through the air from one tree to another is greatly increased by the action of the wind since when the insect may only wish to fly from one leaf to another it may be accidentally borne by the wind to a considerable distance.

The pest does not apparently kill the tree but very seriously affects the crop, and the growth, and as regards the remedy it appears that if the insects have already infested the trees all the leaves so attacked should be cut off and burnt and that spraying in kerosine oil may, in some instances, be advisable.

It is however very satisfactory to learn that if the pest is taken properly in hand on its first appearance there is little chance of its spreading, and if this is the case I may impress again upon those interested in coconuts the importance of seeing that their plantations are thoroughly cultivated and maintained in good order.

COCONUT BEETLES.

The enormous destruction that the two beetles known as the Red Beetle (*Kynchophorus ferrugineus*) and the Black Beetle (*Oryctes rhinoceros*) do, unless the pests are kept well under control is difficult to imagine and it is to the habit of these beetles and the best methods of destroying them and reducing their power of doing serious damage now propose to enter upon.

The Red Beetle: This insect, after it is fully developed does no harm to the tree. It generally lays its eggs at the base of the branches covering the cabbage and so well are they secreted or hidden away that the harm being done is often not detected until it is too late to save the tree. The grub does the havoc, and, soon after it is hatched, commences its operations by gnawing and boring its way inwards until it reaches the very heart of the cabbage. The work

is so rapid and the effects so deadly that these grubs are, in my opinion, very much more dangerous to the life of tree than the black beetles, but fortunately the red beetle is scarcer. It occasionally takes advantage of the borings made by the black beetles to lay its eggs in these cavities only here it is more easily discovered in searches for the black beetle, so that with proper supervision it may, or should, be caught before any serious harm has been done. Apart from these haunts my experience is that there are many other breeding places, a few will be found in manure or rubbish heaps, more again in the rotten dead stumps and roots of sago and serdang palms, and most numerous in a coconut tree from which the top has fallen away through their ravages, or a decayed stump of the same tree. Here the grub will be found covered in a cocoon made of the fibre and so well does it conceal itself in this way that it is practically not noticeable to the ordinary view and is only discovered when the inside of the tree or stump is scooped out, which I need scarcely say must be done very effectually, otherwise one or two of the cocoons may escape observation.

Black Beetles :—It is on account of their great numbers that these beetles are so much to be feared, and the fact that their borings, as I have stated previously, afford a means for inroad by the dangerous red beetle. There absolutely seems to be no limit to the beetles and their grubs, provided the breeding places are sufficiently abundant; and these comprise not only those mentioned in connection with the red beetle but a great many more, such as underneath, and in, dead palms of several kinds, sawdust, paddy, straw, coconut, coffee and paddy husk and refuse heaps of all descriptions. The grubs especially may be found in thousands in quite a small dung heap. When the beetles reach maturity they leave their breeding grounds and it is then they make for the coconut trees and commence their ravages slightly above, and near the top of, the cabbage, boring their way downwards and laying their eggs at the end of the cavities so formed. Owing to their constant and continual onslaughts they do great damage to the trees, nipping as it were the leaves and the stem that bears the fruit just at the time they are forming, the leaves in consequence afterwards present a jagged or frayed appearance and what is more serious the stem often is killed and if it does shoot out probably bears little or no fruit. There is difficulty in ascertaining how far the beetle can travel in one stage of its journeyings which it makes at night, but I should say no great distance and about a mile would, I think, be an extreme limit. However it manages to fly to plantations considerable distances away from one another and this may be accounted for by its finding several haunts intervening to avail itself of during its flight.

Remedial and Preventive Measures.

When the beetles appear it is evident there must be some breeding grounds about. The first thing to do is to search out and destroy all the haunts such as have been described and everything that is likely to harbour the pests should be burnt. Attention must also be given to the trees themselves and with regard to this in the first stage the beetles will often be found on the leaves themselves and are easily collected. If however the beetle has already found its way into or near the cabbage of the palm, it should be immediately dealt with. For this purpose a stiff bit of wire about 18 inches long with a barb at the end is propped into the hole and this answers very well for collecting the beetle or beetles that may be in the trees. These insects must, of course, be at once destroyed. As soon as the beetles have been extracted from the holes, these should be filled up with a mixture of Zotal and dry sand in the proportion of half a glassful of Zotal to $\frac{3}{4}$ of a gantang of sand. Even if no beetle is found in the holes the same treatment should be followed as it effectually prevents any other beetles making use of the same haunt. Again, and this is most important, fine sand should be applied copiously to the cavities at the junction with the trunk as this makes it very difficult for the beetle to make any fresh inlet to the tree.

General.

While the plantation is young or if there is a great number of trees not in bearing, it will of course be necessary to keep some coolies to look after and give special attention to the beetles; but when all the trees are in full bearing or nominally so and the plantation has been previously well maintained it may be possible to keep away any real harm from attack by beetle, merely by employing the coconut collectors while collecting the nuts, generally every two months, to extract the beetles from the tree. This is the common practice in Penang and other places, I know of, the collector usually receiving a (dollar) cent for every beetle he catches.

A Fungus Parasite of the Coconut Beetle.

Dr. K. Friederichs, Government Zoölogist of Samoa, recently discovered at Apia a distinct case of parasitism of the rhinoceros beetle (*Oryctes rhinoceros*) by a more or less cosmopolitan fungus. (*Chromostylin*) [*Metarrhizium*] *anisopliae* Sorokin. Spores of this fungus, which is becoming a very important factor in controlling the pest in some parts of Samoa, were brought to the Philippines in December by Dr. Friederichs and presented to the Bureau of Agriculture. Shortly after his arrival

here he found what appears to be the identical species of fungus attacking larvæ of the rhinoceros beetle near the town of Lucena, Tayabas. Cultures of the fungus which appears to be nearly, if not quite, as virulent as the Samoan form, have been made and a considerable number of both larvæ and adult beetles have been killed in the breeding cages at the Singalong insectary and at the locust office in Intramuros.

It now remains to be seen whether this fungus can be propagated on a large scale and distributed to districts (and to other countries) where in the "Uang" still flourishes. It is quite possible that this fungus parasite will be found to be widely distributed in the Philippines and if so, it is undoubtedly a very effective, if not the principal factor in the way of natural controls which inhibit the spread of this beetle which commits such terrible ravages in the neighbouring tropical countries.



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VENESTA Rubber Chests

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AGENTS IN CALCUTTA,
COLOMBO, BATAVIA.

HANKOW AND
THE STRAITS, Etc.

See p. 196.

Important to Planters.

The Four Oaks

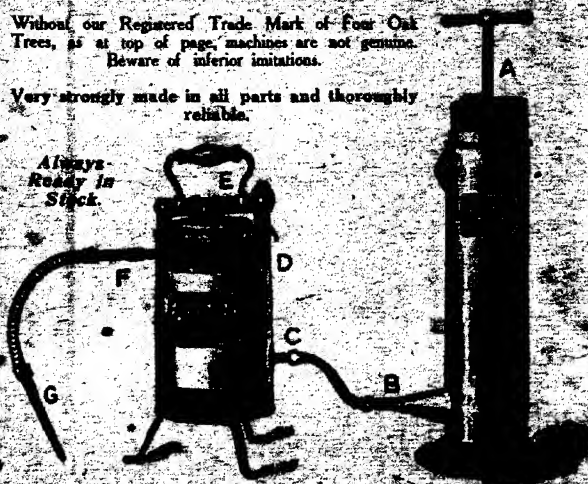
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RUBBER.

Estimate of Cost of Opening and Bringing into Bearing 300 Acres of Hevea Rubber.

Note.—It is inadvisable to clear tops of hills and ridges exposed to wind.

Cost of 300 acres of forest land @ Rs. 100 per acre ... Rs. 30,000

FIRST YEAR. General Charges.

| | | Rs. | Rs. | Cost per Acre. Rs. c. |
|---|--|-------|-------|-----------------------------|
| 1 | SUPERINTENDENCE. | | | |
| | Superintendent's Salary ... | 4,800 | | |
| | Conductor's Salary ... | 900 | 5,700 | 19 00 |
| 2 | ALLOWANCES. | | | |
| | Superintendent, 3 coolies ... | 540 | | |
| | Conductor, 1 cooly ... | 180 | | |
| | Sundries ... | 30 | 750 | 2 50 |
| 3 | CONTINGENCIES. | | | |
| | Commission on Cash ... | 500 | | |
| | Books, Stationery, Postage, Tappal Fees ... | 250 | | |
| | Subscription to Coast Agency @ 40 cents per acre ... | 120 | | |
| | Subscription to Planters' Association ... | 25 | | |
| | Sundries ... | 205 | 1,100 | 3 66 |
| 4 | RECRUITING. | | | |
| | 100 coolies @, Rs. 42 per head ... | — | 4,200 | 14 00 |
| 5 | MEDICAL AID. | | | |
| | Sick Rice, Medicine ... | — | 400 | 1 33 |

Buildings.

| | | | | |
|---|---|--------|------------|-------|
| 6 | BUNGALOWS. | | | |
| | Permanent Superintendent's bungalow ... | 10,000 | | |
| | Permanent Conductor's bungalow ... | 3,000 | 13,000 | 43 34 |
| | Carried forward ... | | Rs. 25,150 | 83 83 |

| | | Rs. | Rs. | Cost per Acre. Rs. c. |
|----|--|-------|------------|-----------------------------|
| | Brought forward ... | | 25,150 | 83 83 |
| 7 | LINES. | | | |
| | Iron Lines of 24 rooms @ Rs. 150 per room, with drains and site cutting complete, say ... | 3,606 | | |
| | Sweeper ... | 144 | 3,750 | 12 50 |
| | | | | |
| | Opening Works. | | | |
| 10 | SURVEY. | | | |
| | 300 acres @ Rs. 1-50 per acre ... | 450 | — | 1 50 |
| 11 | FELLING AND CLEARING. | | | |
| | 300 acres @ Rs. 20 per acre ... | 6,000 | — | 20 00 |
| 12 | LINING AND PEGS. | | | |
| | Lining 20 ft. x 20 ft., including pegs at 1/- Rupee per 1,000, at Rs. 3-50 per acre ... | 1,050 | — | 3 50 |
| 13 | HOLING. | | | |
| | 12 in. x 12 in. x 18 in. deep at Rs. 2-00 per acre ... | 600 | — | 2 00 |
| 14 | FILLING IN AND PLANTING. | | | |
| | At Rs. 1-50 per acre ... | 450 | — | 1 50 |
| 15 | PLANTS. | | | |
| | Cost of Rubber Stumps and transport at Rs. 50 per 1,000, say ... | 1,500 | — | 5 00 |
| | Albizia planting, including cost of stumps at Rs. 15 per 1,000, say ... | 600 | — | 2 00 |
| 16 | ROADS. | | | |
| | Cutting 5 ft. into the solid, and drain 1 ft. x 1 ft. at Rs. 15 per acre ... | 4,500 | — | 15 0 |
| 17 | DRAINS. | | | |
| | Cutting drains 15 in. x 18 in., 35 ft. apart, including Leaders, Turning Stones and Blasting at Rs. 20 per acre ... | 6,000 | — | 20 0 |
| 18 | WEEDING. | | | |
| | Say 9 months at Rs. 2-50 per acre ... | 6,750 | — | 22 50 |
| 19 | TOOLS. | | | |
| | At Rs. 2-50 per acre ... | 750 | 28,850 | 2 50 |
| | Carried forward ... | | Rs. 57,550 | 191 83 |

THE Asiatic Petroleum Co., Ltd.

AGENTS IN CEYLON:

DeMege, Forsyth & Company, Colombo.

Kerosine Oil for illuminating and motive purposes is stocked at:—

| | | |
|----------------|---------------|----------------|
| Alutgama | Hikkaduwa | • Nawalapitiya |
| • Ambalangoda | Horana | • Negombo |
| • Anuradhapura | Ingiriya | • Nugoda |
| • Avissawella | Jaala | • Nuwara Eliya |
| • Badulla | • Jaffna | • Polgahawela |
| • Balapitiya | • Kalutara | • Paliyagoda |
| • Batticaloa | • Kadawatte | • Panadura |
| • Barawela | • Kadugannawa | • Passara |
| • Bandarawella | • Kandana | • Puttalam |
| • Chilaw | • Kandy | • Puwakwatte |
| • Colombo | • Kegalle | • Ratnapura |
| • Dehiowita | • Kurunegalle | • Rambukkana |
| • Dodanduwa | • Madampe | • Talawakelle |
| • Galle | • Matugama | • Tebuwana |
| • Gampola | • Matale | • Teldeniya |
| • Grandpass | • Matara | • Trincomalee |
| • Hambantota | • Minuwangoda | • Veyangoda |
| • Hanwella | • Mirigama | • Yatiyantota |
| • Haputale | • Moratuwa | • Watagoda |
| • Hatton | • Nannoya | • Weligama |
| • Heneratgoda | • Nathandiya | |

• **PETROL ('SHELL' MOTOR SPIRIT)** also stocked.

Lubricating Oils on Application.

Liquid Fuel for Motive Power and Tea-drying obtainable at:—

| | | |
|--------------|----------|------------------|
| Avissawella | Haputale | • New Peradeniya |
| Bandarawella | Hatton | • Nannoya |
| Colombo | Kalutara | • Nawalapitiya |
| Galle | Kandy | • Talawakelle |
| Gampola | Matale | • Watagoda |
| | | • Yatiyantota |

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RUSTON'S GAS ENGINES

with Wood Waste Fuel
or Anthracite Producers

AND

RUSTON'S Complete Combustion OIL ENGINES

are economical and reliable motors

In Ceylon they have been installed in—

| | |
|------------------|-------------------|
| Tea Factories | Fibre Mills |
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| Oil Mills | Engineering Works |

Dedicated Coconut Mills,
Aerated Water Factories,
Stone Quarries, etc.

SOLE AGENTS
WALKER & GREIG, LTD.

RUBBER

155

| | Rs. | Rs. | Cost per Acre. Rs. c. |
|---|-------|--------|-----------------------------|
| Brought forward ... | | 67,550 | 191 83 |
| 20 FENCING AND WATCHMAN. Fencing with 3 strands of Barbed Wire. Watchman 2,200 | 2,200 | — | 7 34 |
| 21 SUPPLYING. At 1/- Rupee per acre 300 | 300 | — | 1 00 |
| | | 2,500 | |
| | | 60,050 | 200 17 |
| Cost of land ... | | 30,000 | 100 00 |
| Cost at 1st year... | | 90,050 | 300 17 |

SECOND YEAR. General Charges.

| | Rs. | Rs. | Cost per Acre. Rs. c. |
|-------------------------------|-------|-------|-----------------------------|
| 1 Superintendent 4,800 | 4,800 | | |
| Conductor 900 | 900 | | |
| 2 Allowances 750 | 750 | | |
| 3 Contingencies 500 | 500 | | |
| 5 Medical Aid 300 | 300 | 7,250 | 24 16 |

Buildings.

| | | | |
|--|-----|-----|------|
| 6 Bungalows Upkeep 150 | 150 | | |
| 7 Lines Upkeep and Line Sweeper 250 | 250 | 400 | 1 33 |

Field Works, Upkeep.

| | | | |
|---|-------|---------|--------|
| 16 Roads @ Rs. 1.50 per acre 450 | 450 | | |
| 17 Drains @ Rs. 1.50 „ 450 | 450 | | |
| 18 Weeding at Rs. 18.00 per acre 5,400 | 5,400 | | |
| 19 Tools 100 | 100 | | |
| 20 Fences and Watchman 300 | 300 | | |
| 21 Supplying 100 | 100 | 6,800 | 22 67 |
| | | 14,450 | 48 16 |
| Cost at end of 1st year ... | | 90,050 | 300 17 |
| „ „ 2nd „ ... | | 104,500 | 348 33 |

THIRD YEAR. General Charges.

| | | Rs. | Rs. | Cost per Acre. Rs. c. |
|---|--------------------|-------|-------|-----------------------------|
| 1 | Superintendent ... | 4,800 | | |
| | Conductor ... | 900 | | |
| 2 | Allowances ... | 750 | | |
| 3 | Contingencies ... | 500 | | |
| 5 | Medical Aid ... | 300 | 7,250 | 24 17 |

Buildings.

| | | | | |
|---|-----------------------------------|-----|-----|------|
| 6 | Bungalows Upkeep ... | 150 | | |
| 7 | Lines Upkeep and Line Sweeper ... | 250 | 400 | 1 33 |

Field Works, Upkeep.

| | | | | |
|-----------------------------|--|-------|---------|--------|
| 16 | Roads @ Rs. 1.00 per acre ... | 300 | | |
| 17 | Drains @ Rs. 1.00 ,, ... | 300 | | |
| 18 | Weeding @ Rs. 12.00 per acre ... | 3,600 | | |
| 20 | Fences and Watchman ... | 300 | | |
| 22 | Cultivation.—Albizzia } Coppicing } @ Rs. 1.50 per acre | 450 | 4,950 | 16 50 |
| | | | 12,600 | 42 00 |
| Cost at end of 2nd year ... | | | 104,500 | 348 33 |
| ,, ,, 3rd ,, ... | | | 117,100 | 390 33 |

FOURTH YEAR. General Charges.

| | | Rs. | Rs. | Cost per Acre. Rs. c. |
|---|--------------------|-------|-------|-----------------------------|
| 1 | Superintendent ... | 4,800 | | |
| | Conductor ... | 900 | | |
| 2 | Allowances ... | 750 | | |
| 3 | Contingencies ... | 500 | | |
| 5 | Medical Aid ... | 300 | 7,250 | 24 17 |

Buildings.

| | | | | |
|--------------------|----------------------------------|-----|-----------|-------|
| 6 | Bungalows Upkeep ... | 150 | | |
| 7 | Lines Upkeep and Line Sweeper .. | 250 | 400 | 1 33 |
| Carried forward .. | | | Rs. 7,650 | 25 50 |

RUBBER

157

| | Rs. | Rs. | Cost per Acre. Rs. c. |
|---------------------|-----|-------|-----------------------------|
| Brought forward ... | | 7,650 | 25 50 |

Field Works, Upkeep.

| | | | | |
|-----------------------------|--|-------|---------|--------|
| 16 | Roads @ Rs. 1-00 per acre ... | 300 | | |
| 17 | Drains @ Rs. 1-00 ,, ... | 300 | | |
| 18 | Weeding @ Rs. 9/- per acre ... | 2,700 | | |
| 22 | Cultivation.—Albizzia } Coppicing } Rs. 1-00 per acre | 300 | 3,600 | 12 00 |
| | | | <hr/> | <hr/> |
| | | | 11,250 | 37 50 |
| Cost at end of 3rd year ... | | | <hr/> | <hr/> |
| | | | 117,100 | 390 33 |
| | | | <hr/> | <hr/> |
| ,, ,, 4th ,, ... | | | 128,350 | 427 83 |
| | | | <hr/> | <hr/> |

FIFTH YEAR. General Charges.

| | Rs. | Rs. | Cost. per Acre. Rs. c. |
|---|---------------------|-------|------------------------------|
| 1 | Superintendence ... | 5,400 | |
| 2 | Allowances ... | 960 | |
| 3 | Contingencies ... | 600 | |
| 4 | Recruiting ... | 360 | |
| 5 | Medical ... | 300 | |
| | | | <hr/> |
| | | | 7,560 |
| | | | <hr/> |
| | | | 25 20 |

Buildings and Machinery.

| | | | | |
|---|---------------|--------|--------|-------|
| 6 | Bungalows ... | 200 | | |
| 7 | Lines ... | 250 | | |
| 8 | Factory ... | 10,000 | | |
| 9 | Machinery ... | 15,000 | 25,450 | 84 83 |
| | | | <hr/> | <hr/> |

Field Works.

| | | | | |
|---------------------|-------------------------|-------|--------|--------|
| 16 | Roads ... | 300 | | |
| 17 | Drains ... | 300 | | |
| 18 | Weeding ... | 1,800 | | |
| 19 | Tools ... | 100 | | |
| 20 | Fences and Watchman ... | 200 | | |
| 22 | Manuring ... | 6,600 | 9,300 | 31 00 |
| | | | <hr/> | <hr/> |
| Carried forward ... | | | 42,310 | 141 03 |
| | | | <hr/> | <hr/> |

| | Ra. | Cost per Acre. Ra. c. |
|---------------------|--------|-----------------------------|
| Brought forward ... | 42,310 | 141 03 |

Crop Works.

| | Ra. | |
|--|--------------------|--------|
| 23 Marking Trees ... | 150 | |
| 24 Tapping Appliances ... | 1,000 | |
| 25 Tapping ... | 4,800 | |
| 26 Collecting Scrap... | 2,000 | |
| 27 Curing and Materials ... | 840 | |
| 28 Packing and Materials ... | 192 | |
| 29 Fuel ... | 240 | |
| 30 Factory Sundries ... | 90 | |
| 31 Transport and Storage ... | 60 | |
| | <u>9,372</u> | 31 24 |
| | 51,682 | 172 27 |
| Cost at end of 4th year ... | 128,350 | 427 83 |
| " " 5th " | 180,032 | 600 10 |
| By 12,000 lbs. netting, say Rs. 1.50 per lb. | 18,000 | |
| Total cost at end of 5th year | <u>Ra. 162,032</u> | |

or say, Rs. 162,000 or Rs. 540 per acre or £36 per acre.



Approximate Crops and Cost of Production, from the Sixth to the Tenth Year from Planting, on an Estate of 380 Acres opened in Hevea Rubber, Planted 20' x 20'.

| Years. | 6th | 7th | 8th | 9th | 10th |
|-----------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | Ra. | Ra. | Ra. | Ra. | Ra. |
| | Cost per lb. Cts. | Cost per lb. Cts. | Cost per lb. Cts. | Cost per lb. Cts. | Cost per lb. Cts. |
| GENERAL CHARGES. | | | | | |
| 1 Superintendence | 6860 | 6860 | 6860 | 6860 | 6860 |
| 2 Allowances | 22-86 | 13-07 | 9-14 | 6-53 | 5-37 |
| 3 Contingencies | 750 | 1-42 | 1-00 | 750 | 750 |
| 4 Recruiting | 600 | 1-33 | 800 | 800 | 800 |
| 5 Medical Aid | 2000 | 3-81 | 500 | 500 | 500 |
| | 350 | -67 | 350 | -33 | -27 |
| BUILDINGS & MACHINERY. | | | | | |
| 6 Bangalows | 300 | 5-71 | 3000 | 400 | 500 |
| 7 Lines | 14000 | 3-81 | 1800 | 500 | 500 |
| 8 Factory | 200 | -38 | 200 | 200 | 200 |
| 9 Machinery | 150 | -38 | 1000 | 500 | 500 |
| FIELD WORKS. | | | | | |
| 16 Roads | 300 | -57 | 300 | 300 | 300 |
| 17 Drains | 300 | -57 | 300 | 300 | 300 |
| 18 Weeding | 1800 | 3-43 | 1800 | 1800 | 1800 |
| 19 Tools | 150 | -29 | 150 | 150 | 150 |
| 20 Fences and Watchman | 200 | -38 | 200 | 200 | 200 |
| 22 Cultivation | 6600 | 15-71 | 8250 | 8250 | 8250 |
| CROP WORKS. | | | | | |
| 23 Marking Trees | 200 | -66 | 300 | 300 | 300 |
| 24 Tapping Appliances | 1000 | 3-23 | 500 | 500 | 500 |
| 25 Tapping | 9000 | 19-05 | 10000 | 10000 | 10000 |
| 26 Collecting Scrap | 3600 | 7-43 | 3500 | 3900 | 3900 |
| 27 Curing and Materials | 1500 | 3-00 | 1575 | 2100 | 2700 |
| 28 Packing and Materials | 430 | 1-60 | 1200 | 1680 | 2160 |
| 29 Fuel | 525 | 1-61 | 1125 | 1575 | 1912 |
| 30 Factory Sundries | 225 | -75 | 367 | 50 | 53 |
| 31 Transport and Storage | 150 | -50 | 375 | 50 | 53 |
| Total cost, and per lb. | 41,240 | 86-84 | 45,985 | 40-91 | 35-12 |
| Total Crop and per acre in lbs. | 30,000 | 175 | 75,000 | 350 | 425 |

RUBBER

159

DETAILS OF EXPENDITURE.

(See previous page.)

- No. 1 Superintendent, Conductor, Horsekeep.
 „ 2 Superintendent, 3 coolies, Conductor, 1 cooly, Sundries.
 „ 3 Coast Agency and Planters' Association fees, Stationery, Postage, Books, Tappal fees, Commission on Cash, Sundries.
 „ 4 At Rs. 40 per cooly.
 „ 5 Dispenser, Medicines, Sick Rice, Hospital bills.
 „ 6 Rubber Curer's Bungalow, †Dispensary and Bungalow, Repairs.
 „ 7 †New Lines, Repairs, Sweepers.
 „ 8 Repairs and General Upkeep.
 „ 9 New parts, Repairs and General Upkeep.
 „ 16/17 General Upkeep.
 „ 18 At 50 cents per acre to include sweeping and general tidying up.
 „ 19 Purchase of New Tools, Repairs.
 „ 20 Repairs and 1 Watchman.
 „ 22 Coppicing Albizzias, Forking Artificial Manure and application half the Estate annually.
 „ 23 Setting out Trees, General attention to reopening incisions.
 „ 24 Knives, Cups, Spouts, Buckets, Repairs.
 „ 25 70% of Crop First quality, C. R. average 40 cents.
 „ 26 30% of Crop other qualities, C. R. average 40 cents.
 „ 27 Curer, Engine Driver, Labour, Acetic Acid, Pails, Straining materials, Factory, Watchman.
 „ 28 Boxes, Hoop Iron, Nails, Labour, Closing.
 „ 29 Firewood, Liquid Fuel, Kerosine Oil.
 „ 30 Machine Oils, Lighting, Cotton Waste, Sundries.
 „ 31 Estate to Colombo.

Statement showing Prices to be realized on Crops given in the foregoing table, and produced for the figures stated, to give a 15% return on the Capital Outlay of Rs. 137,000, or Rs. 456 per acre.

| Year. | Crop per Acre. lb. | Costing per lb. cts. | Realizing per lb. cts. | Profit per lb. cts. | On Capital Out- lay of Rs. 540 per acre. |
|-------|--------------------------|----------------------------|------------------------------|---------------------------|--|
| 6th | 100 | 137.46 | 218.46 | 81.00 | 15% |
| 7th | 175 | 86.84 | 133.13 | 46.29 | 15% |
| 8th | 250 | 61.31 | 93.71 | 32.40 | 15% |
| 9th | 350 | 40.91 | 64.06 | 23.14 | 15% |
| 10th | 425 | 35.12 | 54.18 | 19.06 | 15% |

LABOUR.**AVERAGE WORK OF A COOLY PER DAY.**

| | | From | To |
|-----------------|---------------------------------------|------|---------|
| Holing | 12 in. × 12 in. × 18 in. deep ... | 20 | 30 |
| Filling | ... .. | 50 | 80 |
| Planting | ... .. | 50 | 80 |
| Cutting Pegs... | ... .. | 400 | 500 |
| Drains | 15 in. × 18 in. deep ... | 33 | 40 feet |
| Roads | 6 feet in solid, exclusive side drain | 17 | 33 " |
| Road Drain | 12 in. × 12 in. ... | 60 | 75 " |

CULTIVATION OF RUBBER LAND AND COST OF OPENING.

Planting 20 ft. × 20 ft., say 100 trees to an Acre.

| | | From | To |
|--------------------------------------|------------------|--------|--------|
| | | Rs. c. | Rs. c. |
| Felling and Clearing | per Acre. | 10 00 | 20 00 |
| Lining, including Pegs | ... .. | 2 00 | 3 50 |
| Holing | ... .. | 1 50 | 2 00 |
| Filling in | ... .. | 1 00 | 1 50 |
| Planting | ... .. | 0 50 | 1 00 |
| *Roading | ... .. | 10 00 | 15 00 |
| Roads Upkeep... | ... .. | 1 00 | 1 50 |
| *Draining 35 feet apart with leaders | ... .. | 12 00 | 16 00 |
| Drains Upkeep | ... .. | 1 00 | 1 50 |
| Weeding 1st year per acre per month | ... .. | 1 50 | 2 00 |
| " 2nd " " " " | ... .. | 1 00 | 1 50 |
| " Afterwards " " " | ... .. | 0 50 | 1 00 |

* This includes turning stones, unless the land is very rocky necessitating drilling and blasting.

DRAINS.

| Distance Apart | Linear Feet | Chains per Acre. | Cost per Acre. |
|----------------|-------------|------------------|----------------|
| Feet. | per Acre. | | Rs. c. |
| 30 | 1,452 | 22 | 17 60 |
| 35 | 1,244 | 19 | 15 20 |
| 40 | 1,089 | 16 | 12 80 |
| 45 | 968 | 14 | 11 20 |
| 50 | 871 | 13 | 10 40 |
| 55 | 792 | 12 | 9 60 |
| 60 | 726 | 11 | 8 80 |
| 65 | 670 | 10 | 8 00 |
| 70 | 622 | 9 | 7 20 |

Divide the distance at which the drains are to be cut into 43,560 sq. feet; the number resulting from the division will give the linear feet, and that again divided by 66 will give the number of chains per acre. The cost largely depends upon the nature of the land being opened and the class of labourer available, but the above figures are arrived at on the assumption that a cooly cuts 33 ft. of a drain 15 in. wide \times 18 in. deep per diem, and rated at a Check Roll average of 40 cts.

This is for surface only, a proportionate addition must be made on steep lands.

SEED AND NURSERIES.

Table showing size of Nursery required for Seed at Various Distances.

| Distance apart Seed. In Inches. | Area in Sq. Inches. Per Seed. | No. of Seed required for a Bed of 6 ft. by 24 feet, or 144 Sq. Feet. |
|------------------------------------|----------------------------------|--|
| 4 in. by 4 in. ... | 16 inches | 1,296 Seed |
| 5 in. by 4 in. ... | 20 " | 1,036 " |
| 6 in. by 4 in. ... | 24 " | 864 " |
| 5 in. by 5 in. ... | 25 " | 829 " |
| 6 in. by 5 in. ... | 30 " | 691 " |
| 6 in. by 6 in. ... | 36 " | 576 " |

The selection of seed is of very great importance, preference should therefore be given to seed taken from healthy and good laticiferous yielding trees.

In putting seed out in the nurseries, care should be taken in seeing that the seed is placed on its flat side or in a horizontal position. Any other position results in a plant with a twisted root. Beds of 6 ft. by 24 ft. will be found the most suitable as it allows them being properly weeded and watered as occasion demands. In preparing nurseries a cooly's task is a bed of 6 ft. \times 24 ft. or 144 sq. feet, this includes digging of side drains, removing stones, stumps, cheddy, &c., and handing the beds over ready for the seed.

DISTANCES OF TREES AND NUMBER PER ACRE.

$$4,840 \text{ Sq. Yards} = 43,560 \text{ Sq. Feet} = 1 \text{ Acre.}$$

To obtain the number of trees to the acre planted at various distances, multiply the distance between the trees planted down the line, by the distance between the lines, and divide that figure into 43,560 sq. ft., the quotient will give the number required.

$$\text{Example: } 20 \text{ ft. by } 20 \text{ ft.} = 400 \text{ sq. ft.}$$

$$43,560 \text{ sq. ft.} \div 400 = 108 \text{ trees to the acre.}$$

The following table shews at a glance the number of trees from 15 x 15 to 25 x 25.

| Feet | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 15 | 193 | 181 | 170 | 161 | 152 | 145 | 138 | 132 | 126 | 121 | 116 |
| 16 | 181 | 170 | 160 | 151 | 143 | 136 | 129 | 123 | 118 | 113 | 108 |
| 17 | 170 | 160 | 150 | 142 | 134 | 128 | 122 | 116 | 111 | 106 | 102 |
| 18 | 161 | 151 | 142 | 134 | 127 | 121 | 115 | 110 | 105 | 100 | 96 |
| 19 | 152 | 143 | 134 | 127 | 120 | 114 | 109 | 104 | 99 | 95 | 91 |
| 20 | 145 | 136 | 128 | 121 | 114 | 108 | 103 | 99 | 94 | 90 | 87 |
| 21 | 138 | 129 | 122 | 115 | 109 | 103 | 98 | 94 | 90 | 86 | 83 |
| 22 | 132 | 123 | 116 | 110 | 104 | 99 | 94 | 90 | 86 | 82 | 79 |
| 23 | 126 | 118 | 111 | 105 | 99 | 94 | 90 | 86 | 82 | 78 | 75 |
| 24 | 121 | 113 | 106 | 100 | 95 | 90 | 86 | 82 | 78 | 75 | 72 |
| 25 | 116 | 108 | 102 | 96 | 91 | 87 | 83 | 79 | 75 | 72 | 69 |

RUBBER SEED.

Proportionate weight of kernels to shells is as 5 to 3.

About 20% of the fresh kernel is composed of moisture.

Drying Kernels.—Either by rotary kilns using the shells as fuel, or by adopting the Barbecue system, drying in the sun.

Pack in bags for shipment.

Price ranges for decorticated seed from £9 to £12 per ton c.i.f. an English Port. Cost of seed collection in F.M.S., by employing children, 5 (dollar) cents per 1,000.

| | | | |
|-----------|---------------|----------|--------------------|
| 180 seeds | = | 1 lb. | } F. M. S. figures |
| 288 | Fresh Kernels | to 1 lb. | |
| 360 | Dry | " " | |
| 806,400 | " | " to ton | |

Ceylon (Mr. C. O. Macadam).

1 million fresh seed = 1 ton dry kernels.

| | | | | |
|-------------|-------|-----|------|----------------------|
| Producing— | owts. | qr. | lbs. | |
| Oil 30-35% | ... | 7 | 3 | 13 @ £25 = £10 |
| Cake 60-65% | ... | 12 | 0 | 15 £7.10 = £4.10 |
| | 20 | 0 | 0 | price per Ton £14.10 |

HEVEA RUBBER SEED FOR OIL.

Cost of One Million Seed.

| | | R. c | Cost per lb. Dry Kernels Cents. |
|---|---------------------------------|-------------|---------------------------------------|
| Collecting | @ Cts. 5 per 1000 | 50-00 | 1-68 |
| Machine Cracking and Packing | @ Cts. 1-03 per 1000 | 10-30 | -35 |
| Bags | ... 100 at 15 cents | 15-00 | -51 |
| Transport. | Tons 3.19-1.17.—Nett 8,693 lbs. | | |
| | Cart Hire, Estate to Station | 25-00 | -84 |
| | Rail Freight to Colombo | 58-95 | 1-91 |
| Shelling, and Drying on Barbecue | ... | 29-14 | -98 |
| For 2,973 lbs. Dry Kernels, 30 Bags at 20 cents | ... | 6-00 | -20 |
| Bulking, Weighing and Packing | ... | 3-54 | -12 |
| Marking and Loading Carts | ... | 1-00 | -03 |
| Shipping 2,973 lbs. @ $\frac{1}{2}$ cent | ... | 14-86 | -50 |
| Total cost of 2,973 lbs. Dry Kernels | | Rs. 211-79 | 7-12 |
| or Cost per Ton | | Rs. 159-48. | |

HEVEA RUBBER SEED FOR OIL.

Cost of 3,681 lbs. Dry Kernels.

| | | Cts. | Cost per lb. |
|------------------------------------|-----|------|--------------|
| Collecting | ... | ... | 2-42 |
| Decorticating | ... | ... | 2-26 |
| Drying in D/D Sirocco | ... | ... | -92 |
| Packing, including Bags | ... | ... | -21 |
| Cart Hire, Estate to Station | ... | ... | -49 |
| Rail Freight to Colombo | ... | ... | -71 |
| Receiving Charges Colombo, Carting | ... | ... | -16 |
| Shipping | ... | ... | -50 |
| Total Cost per lb. | | | 7-67 |

Cost per Ton Rs. 171-80

Milling Costs to be added.

An "Empire" Oil Mill for treating 7 cwts. of seeds per hour would cost complete, say £600.

WALTER GRAHAM & CO., KEARLEY OIL MILLS, GREENWICH,
result of crushing undecorticated seed, oil yield 20%.

Analysis of cake—

| | | | |
|---------------------|-----|-----|-----------------|
| Moisture | ... | ... | 11.52 per cent. |
| Oil | ... | ... | 6.08 " " |
| Albuminoids | ... | ... | 15.31 " " |
| Carbohydrates, etc. | ... | ... | 31.97 " " |
| Indigestible Fibre | ... | ... | 32.54 " " |
| Mineral matter | ... | ... | 2.58 " " |
| | | | 100.00 |

Undecorticated seed cake would fetch low prices compared with other oil cakes. The oil classed as drying oils, probable value £28 per ton.

Decorticated seed, oil yield 30%, but quality inferior to that pressed from decorticated seed. Cake, however, superior.

TAPPING OF RUBBER TREES.

Experiments carried out in Kuala Lumpur proved that the half herring-bone with superimposed cuts of 18 inches tapped every day gave a considerably larger yield of latex than any of the others, while opposite quarters tapped on alternate days gave a poorer yield than any of the other systems.

It was noticeable in the experiments that the trees tapped every day, in each case, gave a larger yield of total rubber than those tapped on alternate days. The difference in the yield of scrap is particularly evident.

Whatever the Kuala Lumpur experiments may have proved as regards yield, it is now generally accepted by all up-to-date Managers that superimposed half herring-bone cuts are highly undesirable for the following reasons:—

- (1) Bark removal in excess of rate of renewal
- (2) Weakening of rubber content of latex and consequent lowering of quality of finished product.
- (3) Denudation of starch in wood resulting in distortion of shape of tree.

Regarding *every day* tapping, this gives good results for a comparatively short period, but ultimately ends in actual loss of crop, and vitality of the tree, for the three above stated reasons which apply in this case as well.

INCREASED YIELD AT LONG INTERVALS.

BY THE LATE DR. LOCK.

"There is evidence that in the case of old trees closely planted a better result can be obtained by increasing the interval between successive tappings, although Group I (which was tapped with the greatest frequency) gave the highest total yield, the bark was so much injured by the rapid tapping that no further extraction was possible for some time. After the tapping has been in progress for $3\frac{1}{2}$ years it appears that the longer the interval between successive tappings the greater is the yield per tapping.

Considering the total yields of rubber per month, this yield is greatest at first from the tapping at more frequent intervals. The relative yield from the trees tapped at longer intervals, however, gradually increases. After $3\frac{1}{2}$ years' continuous tapping of the same tree, the yield from trees tapped once a week may become as great as, or greater than, that from trees tapped at any shorter interval.

The ideal rate of tapping may be defined as that rate which is associated with the greatest increase in yield as time goes on.

The rate of tapping should be reduced if the concentration of rubber in the latex falls much below 30 per cent."

[Every third day tapping is now found to be the longest interval to be profitably adopted; and is a very sound system for estates which have a small reserve of mature tappable bark due to incorrect methods in the past.—(1917)]

TAPPING OF PERMANENT TREES.

BY STANLEY ARDEN, F.L.S., IN THE I. R. JOURNAL.

When we consider the physical effects of tapping, the question arises whether it would not be advisable to select about fifty of the best trees per acre, and to leave them entirely untapped—i.e., after their capabilities had been proved by initial tapping. I do not fancy that this idea will meet with general assent, but I put it forward as a basis for discussion. At any rate, if this is done, or if the trees which are to form the plantation of the future are selected and tapped very lightly, and their development encouraged in every way, there would not be the same objection to the rather more drastic tapping of the remainder of the trees. It certainly seems somewhat unnecessary to concern ourselves about the conservation of the bark of trees which it is intended to remove, and consequently to be content with an output which might safely be increased. If the permanent trees are tapped at all I would suggest that the quarter-section system with a single incision to the left be adopted,

while those which are to be eventually discarded might be tapped on the same principle, but with two incisions to the left of the central channel, 18 inches apart, or even three incisions 12 inches apart; and those trees which are to be removed in the near future might have four or even six incisions 9 inches or 6 inches apart respectively.

The various systems of tapping here suggested may seem to present somewhat formidable problems in estate management, but they are not really so troublesome as may appear. I would suggest that all the trees ready for tapping be marked with broad white bands so as to be easily distinguishable from a distance; (distemper, "outside quality," is a cheap and efficient marking material) if the number of bands on each tree are made to coincide with the number of incisions it is intended to make, so much the better, as the risk of error is thereby lessened, for if it is possible to make a mistake the Tamil coolie may be depended upon to make it. The work would be greatly facilitated if the permanent trees were tapped by a special gang of tappers. These should be recruited from amongst the most careful tappers on the estate, and if they received a rather better rate of pay, and promotion to this gang was made the reward for good work, the arrangement would conduce to careful tapping throughout the estate. An extra 5 cents per diem per coolie would only amount to 25-35 cents per acre per mensem, according to the number of permanent trees, though the cost of collection would in any case be slightly increased as the coolies would have to cover more ground.

Having regard to the future of the rubber planting industry it can not be too strongly emphasised that the welfare of the trees and not "all-in costs" should be the paramount consideration, and the sooner this is recognised the better it will be for the industry. To satisfy the legitimate aspirations of present-day shareholders and, at the same time, to conserve the vitality of those trees which are to form the plantations of the future, ought not to prove incompatible tasks.

ALTERNATE DAY TAPPING.

BY S. MORGAN.

"The yield of latex is disproportionate when we increase the number of incisions or shorten the period between consecutive tappings. In all probability this deficiency of latex is accompanied by a small percentage of caoutchouc. The percentage of caoutchouc in the latex is highest in the lightest system of tapping and lowest where the heaviest system of tapping is imposed.

Of the other systems employing the half herring-bone on a quarter of the tree, that in which the trees were tapped on alternate days certainly gave the best results. Contrasting these figures with those of the

same system tapped every day, it is not found that the latter (daily tapping) gives twice the volume of latex or twice the quantity of dry rubber. On the contrary, the yield of dry rubber per tapping is highest in the alternate day system than in the every day system.

While every day tapping naturally gives a higher yield of dry rubber for the whole period, the alternate day system gives a higher yield of dry rubber per tapping, and also shows a higher percentage of dry rubber in the latex."

A SCHEME FOR THINNING RUBBER BY SELECTION.

By A. L. BAINES.

Planted 10 by 10 or 15 by 15

Trees to be taken in groups of three and one tree cut out from each group, it is often difficult to select between two trees, but there is usually a distinct choice in three. This gives one an opportunity of cutting out—

- (a) Trees which are planted too near to the road.
- (b) Trees planted too near to the lower side of a drain.
- (c) Trees which have gone out of shape.
- (d) Undesirable doubles.
- (e) Diseased trees and weaklings.
- (f) Badly tapped trees.

This system takes out 66 trees to the acre, leaving 132, which can be further reduced later, if so desired.

This is all of very little value now when we know there is nothing to beat one cut on half spiral, tapping on alternate days, and changing over to new cuts on opposite side every six months.

SMOKED SHEET.

By L. M. W. WILKINS.

Of recent years the method of manufacturing rubber in plain biscuit form has gradually given place to sheet, dried in smoke, and prepared in some rubbed or diamond cut pattern to prevent adhesion in packing.

The old fashioned biscuit caused considerable trouble by the tendency to grow moulds and mildews, for which reason smoking has been adopted, which, when thoroughly done, prevents these disfiguring growths by the antiseptic action of the various constituents of the smoke; besides improving the keeping qualities of the rubber.

In the preparation of smoked sheet one of the most important points to be kept in view is uniformity, and this can only be obtained by standardising the latex to a constant caoutchouc content by use of a Latexometer or Metrolac. It is usual to fix the strength in bulking baths at about $1\frac{1}{2}$ lbs. dry rubber per gallon of dilute latex, after which

equal quantities of latex (after the addition of the coagulant in bulk), are poured into the coagulating dishes, which have to be of exactly standard dimensions.

In the case of the 18" x 11½" x 3' dish, exactly one gallon of dilute latex is the usual amount employed and the resultant sheet therefore weighs 1½ lbs. when dry if the above stated dilution has been carefully worked to.

The usual period for coagulation is roughly 18 hours, i.e. latex put out in coagulating pans at noon is rolled next day at 6 a.m. In the use of coagulants, only enough acid should be used to set up coagulation in good time, it being not only wasteful but actually harmful to the quality of the finished rubber to use more acid than necessary.

On being removed from the pans the coagulum is passed four or five times through a set of smooth rollers till brought down to the desired thickness, after which the sheet goes once through the diamond or ribbed roller, which machine should be driven very slowly or the pattern will not be thoroughly impressed on the surface.

After rolling it will be noticed that the sheets are still dripping with moisture containing a good deal of serum, or "Mother Liquor." To prevent "rustiness" it is important to wash this off, which can easily be done by pulling each sheet as it comes away from the pattern roller through a small tank of clean water.

The next operation is smoking, but it is not advisable to put the sheets straight into the smoke house while still dripping wet, consequently some estates arrange for hangers in a verandah, or lean to, close to the smoke house, where sheets can be hung up to drip off all surface moisture.

Various types of houses, hangers and furnaces are employed, but undoubtedly the most successful is the upstair or "Kent" type house with the fire in a large deep hole out in the floor, the rubber being hung in the upper storey where it is not reached by the heavier bodied or tarry particles in the smoke.

The deep hole-in-floor type of furnace is all round the best, being safer and more economical with fuel as the rate of combustion can only be slow. Usual temperature is 110°.

Various types of hangers are in use and there is not much difficulty in hitting on a serviceable pattern. Wires or rods should be avoided and the hangers spaced, and of such width, that the sheets cannot touch each other, while at the same time provision should be made for every sheet to be easily accessible to the coolies working the room, as it is necessary to turn the sheets over every second day in order to smoke evenly.

If the smoke house has a tin or sheet iron roof, some form of ceiling should be employed or in wet weather condensation of smoke will take place on the inner surface of the roof, and sheets will be disfigured by the resultant dripping of liquid smoke.

No hard and fast rule can be laid down as to time required for smoking as so much depends on the thickness of sheet, weather, fuel, type of house, and buyers ideas as to whether a sheet is over or under smoked. In some cases a sheet is ready in five days, and, under other conditions, twelve days sometimes barely enough.

After smoking if the sheets present a glazed or rusty appearance they can be much improved by scrubbing with a stiff brush in clean water till free of deposit, and hung up on wires or other hangers till surface moisture has again dried or dripped off before packing.

Air bubbles in sheet are due to dirty pans or latex strainers, causing infections of a yeast-like nature in the new coagulum each day, or to too high a temperature in smoke house.

The advantages in favour of manufacture of smoked sheet in comparison with crepe are:—

- (1). Cheap machinery and less depreciation.
- (2). Motor power not required.
- (3). Cheaper fuel bill.
- (4). Less acid used.
- (5). No Sodium Bisulphite required.
- (6). More sheet packable per chest.
- (7). 3% more dry rubber for same latex, representing anything from $\frac{3}{4}$ to $1\frac{1}{4}$ cents saving over crepe per lb. dry rubber, under various conditions.—(1917.)

OCCURRENCE OF BUBBLES IN SHEET RUBBER.

BY M. BARROWCLIFF.

The formation of the small air bubbles that are not infrequently met with in plantation sheet has been variously ascribed (a) to the use of too much or too strong acid when coagulating and (b) to the employment of too little acid. In endeavouring to decide which of the above somewhat divergent statements more nearly approximated to the truth it fell to the writer's lot to obtain bubbles with every proportion of acid employed, from the minimum possible to the maximum practicable.

The problem, thus appearing to be less simple than it seemed at first sight, was subjected to more extended experiments to define the conditions predisposing to bubble formation, and the conclusions about to be given were arrived at.

The underlying reason for bubbles appearing at all is of course that certain gases, either those of the atmosphere, oxygen and nitrogen, but mainly carbon di-oxide, which are originally dissolved or combined in the latex subsequently become liberated at a time when their free access to the air is prevented, *i. e.*, during or after coagulation, and thus are compelled to remain embedded in the rubber.

To show how this may happen it will be convenient to follow through the various processes of the preparation of rubber and to point out under what conditions at each stage bubble development may occur.

On adding the coagulant to the latex there is usually a brisk effervescence and escape of gas. This is due to the interaction of the acid with bicarbonates of magnesium and calcium which are contained in the latex, the gas evolved being carbon di-oxide. Obviously, then, if excess of acid is used and coagulation sets in rapidly, part of this gas will be imprisoned and form bubbles, as becomes evident after drying the rubber.

A too rapid coagulation therefore is the first cause, taking them in order, leading to bubble formation.

On the other hand if too little acid is used, bubbles—and in particular “coagulation marks,” the pocked appearance caused by bubbles forming and bursting on the under surface of the sheet—will again almost certainly be obtained.

The cause in this case is less obvious, but may be due either to a gradual decomposition of the bicarbonates or to the setting in of putrefactive alterations. That too little acid is being used is indicated by an excessive surface darkening and oxidation taking place during and after coagulation.

If on the other hand the employment of more acid effects coagulation too quickly then an unduly diluted latex is probably being dealt with and less water should be added in the field.

However assume that the correct quantity of coagulant has been used and that the mixture has been transferred to the dishes. It is now saturated with carbon di-oxide at the prevailing atmospheric temperature. The solubility of this gas in water and in such solutions as that we are dealing with however decreases as the temperature rises, any increase in the temperature causing a further portion to be expelled from the solution.

If then, owing perhaps to the factory getting more sun in the afternoon than in the morning, the coagulum gets warmer, this carbon di-oxide will be evolved and must form bubbles in endeavouring to escape.

This is the next point to observe therefore if trouble of the nature under discussion is being experienced, that the temperature of the room

in which the dishes are standing should not be higher afterwards than at the time of coagulation. If it does get higher better ventilation is called for.

The safe passage of the sheet to and through the rolling stage must not however, as might perhaps be thought, be the signal for the cessation of vigilance. It still contains up to 35% of the solution, saturated with gas that may yet cause trouble.

If the rolling has been tight, especially if differential rollers have been used, further risk is small as the greater part of the solution will drain out in the course of a few hours, carrying the gas with it. If on the other hand the rubber has been evenly rolled, and not very tightly, the rate of drainage is very slow and a large amount of water will be still remaining when the sheet is placed in the smoke house.

Whilst in this state any appreciable rise in temperature, such as may be caused by having too large a fire or to the sheet being hung too near to it, will produce a luxuriant crop of bubbles.

This is the last of the list of possibilities, and, as the phenomenon only needs to be clearly understood for the necessary preventive measures to become obvious, it is hoped that these notes will assist in the avoidance of this particular one of the minor defects to which sheet rubber is subject.

As a rule a latex containing approximately 12% of rubber, pure latex diluted with an equal volume of water, will require $2\frac{1}{2}$ to $5\frac{1}{2}$ oz. of a 5% acetic acid solution per gallon to effect a satisfactory coagulation for sheet rubber.

[Mr. Barrowcliff's observations are correct enough, but in practice it is more often found that bubbles and cloudy patches in sheets are caused by imperfect cleansing and sterilising of dishes, in which minute particles of old coagulum remain, and set up fermentations or yeast-like action in fresh latex, resulting in bubbles and blotches. Thorough cleansing and scalding of dishes are the remedies. - (1917)]

THE IDEAL CASE FOR PACKING RUBBER.

By L. WROY in *Agricultural Bulletin*, F.M.S.

A case should be so constructed that when the lid is removed, the rubber should slip out with ease, and it should not be necessary to break any wood, which might cause splinters, in opening it. It might be thought that if rubber can be put into a box it can be got out again with equal facility, but after a voyage the whole contents of the box become a more or less solid mass, and it requires only slight projections on the inner surface of the box effectually to prevent its removal. It should

not be a difficult matter to design a satisfactory box for rubber, when once the conditions are formulated. These appear to be:—

- (1). The material of which it is constructed should be sufficiently strong to stand a voyage involving a reshipment.
- (2). They should have a smooth, planed, inner surface, and be close fitting, so as to exclude dust and dirt.
- (3). They should be hard to tamper with in transit.
- (4). They should be capable of being opened without its being necessary to fracture the wood.
- (5). When open there should be no obstacles to the free exit of the contents.
- (6). They should be capable of being re-closed for reshipment, in original cases, if necessary.
- (7). The dimensions should be such as to take rubber from the size of mills most generally in use.

With a packing case made to comply with these conditions practically all difficulties due to the intrusion of foreign matter would disappear.



PROFIT TABLE ON CAPITAL EXPENDED AND ON YIELD PER ACRE.

Table shewing Percentage of profit from Rubber at varying Capital Costs per acre, on a yield of 300 lbs. per acre at 1s. 4d. per lb., cost of production, freight, insurance, selling charges, and London management:—

| Capital Cost ^a per acre. | SELLING PRICE OF RUBBER PER L.B. | | | | | | | | | | | | | | |
|--|----------------------------------|------|----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|
| | 1/8 | 1/10 | 2/ | 2/2 | 2/4 | 2/6 | 2/8 | 2/10 | 3/ | 3/8 | 4/ | 4/6 | 5/ | 5/6 | 6/ |
| | | | | | | | | | | | | | | | |
| £250 0 0 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 14 | 17 | 20 | 23 | 26 |
| 125 0 0 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 28 | 34 | 40 | 46 | 52 |
| 83 6 8 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 42 | 51 | 60 | 69 | 78 |
| 62 10 0 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 56 | 68 | 80 | 92 | 104 |
| 41 13 4 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 84 | 102 | 120 | 138 | 156 |
| 31 5 0 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 112 | 136 | 160 | 184 | 208 |
| 20 16 8 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 168 | 204 | 240 | 276 | 312 |

| At 1d. per lb. profit. | | Profit per acre. | |
|------------------------|------------------------|------------------|------------------------|
| Yield per acre. | At 1d. per lb. profit. | Profit per acre. | At 1d. per lb. profit. |
| 240 lbs. | ... | £1 0 0 | ... |
| 300 " | ... | 1 5 0 | ... |
| 360 " | ... | 1 10 0 | ... |
| 420 " | ... | 1 18 0 | ... |
| 480 " | ... | 2 0 0 | ... |

H. K. R.

RUBBER

175

TO ASCERTAIN THE YIELD IN LBS. AND TONS FOR ANY GIVEN ACREAGE.

| Acreage. | 2,000 lbs. per Acre. | | | 250 lbs. per Acre. | | | 300 lbs. per Acre. | | | 350 lbs. per Acre. | | |
|----------|----------------------|----------|------------|--------------------|------------|-----------|--------------------|-----------|------------|--------------------|------------|-----------|
| | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. |
| 10 | 2,000 | .89 | 2,500 | 5.11 | 3,000 | 1.33 | 3,500 | 1.56 | 4,000 | 1.81 | 4,500 | 2.04 |
| 50 | 10,000 | 4.46 | 12,500 | 5.58 | 15,000 | 6.85 | 17,500 | 7.81 | 20,000 | 8.92 | 22,500 | 10.20 |
| 100 | 20,000 | 8.92 | 25,000 | 11.16 | 30,000 | 13.39 | 35,000 | 15.62 | 40,000 | 17.85 | 45,000 | 20.43 |
| 150 | 30,000 | 13.39 | 37,500 | 16.74 | 45,000 | 20.08 | 52,500 | 23.43 | 60,000 | 26.78 | 67,500 | 30.25 |
| 200 | 40,000 | 17.85 | 50,000 | 22.32 | 60,000 | 26.78 | 70,000 | 31.25 | 80,000 | 35.69 | 90,000 | 40.17 |
| 250 | 50,000 | 22.32 | 62,500 | 27.90 | 75,000 | 33.48 | 90,000 | 40.17 | 105,000 | 46.87 | 120,000 | 53.57 |
| 300 | 60,000 | 26.78 | 75,000 | 33.48 | 90,000 | 40.17 | 105,000 | 46.87 | 120,000 | 53.57 | 135,000 | 60.26 |
| 400 | 80,000 | 35.71 | 100,000 | 44.84 | 120,000 | 53.57 | 140,000 | 62.50 | 160,000 | 71.42 | 180,000 | 80.35 |
| 500 | 100,000 | 44.84 | 125,000 | 55.80 | 150,000 | 66.96 | 175,000 | 78.12 | 200,000 | 89.28 | 225,000 | 100.44 |
| 600 | 120,000 | 53.57 | 150,000 | 66.96 | 175,000 | 78.12 | 200,000 | 89.28 | 225,000 | 100.44 | 250,000 | 111.60 |
| 700 | 140,000 | 62.50 | 175,000 | 78.12 | 200,000 | 89.28 | 225,000 | 100.44 | 250,000 | 111.60 | 275,000 | 123.23 |
| 800 | 160,000 | 71.42 | 200,000 | 89.28 | 225,000 | 100.44 | 250,000 | 111.60 | 275,000 | 123.23 | 300,000 | 133.92 |
| 900 | 180,000 | 80.35 | 225,000 | 100.44 | 250,000 | 111.60 | 275,000 | 123.23 | 300,000 | 133.92 | 325,000 | 144.62 |
| 1,000 | 200,000 | 89.28 | 250,000 | 111.60 | 275,000 | 123.23 | 300,000 | 133.92 | 325,000 | 144.62 | 350,000 | 156.25 |
| 1,500 | 300,000 | 133.92 | 375,000 | 167.40 | 450,000 | 200.89 | 525,000 | 234.37 | 600,000 | 267.85 | 675,000 | 301.25 |
| 2,000 | 400,000 | 178.52 | 500,000 | 223.23 | 600,000 | 267.85 | 700,000 | 312.50 | 800,000 | 356.96 | 900,000 | 401.78 |
| 3,000 | 600,000 | 267.85 | 750,000 | 334.80 | 900,000 | 401.78 | 1,050,000 | 468.75 | 1,200,000 | 535.71 | 1,350,000 | 602.60 |
| 4,000 | 800,000 | 357.14 | 1,000,000 | 446.42 | 1,200,000 | 535.71 | 1,400,000 | 625.00 | 1,600,000 | 714.29 | 1,800,000 | 803.57 |
| 5,000 | 1,000,000 | 446.42 | 1,250,000 | 558.03 | 1,500,000 | 669.64 | 1,750,000 | 781.25 | 2,000,000 | 892.86 | 2,250,000 | 1,004.48 |
| 7,500 | 1,500,000 | 669.64 | 1,875,000 | 837.05 | 2,250,000 | 1,004.48 | 2,625,000 | 1,171.87 | 3,000,000 | 1,339.28 | 3,375,000 | 1,506.50 |
| 10,000 | 2,000,000 | 892.86 | 2,500,000 | 1,116.07 | 3,000,000 | 1,339.28 | 3,500,000 | 1,562.50 | 4,000,000 | 1,785.71 | 4,500,000 | 2,000.00 |
| 25,000 | 5,000,000 | 2,232.14 | 6,250,000 | 2,790.17 | 7,500,000 | 3,348.21 | 8,750,000 | 3,906.25 | 10,000,000 | 4,464.29 | 11,250,000 | 5,016.25 |
| 50,000 | 10,000,000 | 4,464.28 | 12,500,000 | 5,580.35 | 15,000,000 | 6,696.42 | 17,500,000 | 7,812.50 | 20,000,000 | 8,928.57 | 22,500,000 | 10,044.64 |
| 100,000 | 20,000,000 | 8,928.57 | 25,000,000 | 11,160.71 | 30,000,000 | 13,392.85 | 35,000,000 | 15,625.00 | 40,000,000 | 17,857.14 | 45,000,000 | 20,000.00 |

If the exact acreage is not given above it can be computed by addition. Thus 6,660 acres are arrived at by adding 5,000 + 1,500 + 150 + 10.

TO ASCERTAIN THE YIELD IN LBS. AND TONS FOR ANY GIVEN ACREAGE.

| Acreage. | 400 lbs. per Acre. | | 450 lbs. per Acre. | | 500 lbs. per Acre. | | 550 lbs. per Acre. | | 600 lbs. per Acre. | |
|----------|--------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------|-----------|
| | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. | Lbs. | Tons. |
| 10 | 4,000 | 1.78 | 4,500 | 2.00 | 5,000 | 2.23 | 5,500 | 2.45 | 6,000 | 2.67 |
| 50 | 20,000 | 8.92 | 22,500 | 10.00 | 25,000 | 11.16 | 27,500 | 12.27 | 30,000 | 13.39 |
| 100 | 40,000 | 17.85 | 45,000 | 20.08 | 50,000 | 22.32 | 55,000 | 24.55 | 60,000 | 26.78 |
| 150 | 60,000 | 26.78 | 67,500 | 30.13 | 75,000 | 33.48 | 82,000 | 36.83 | 90,000 | 40.17 |
| 200 | 80,000 | 35.75 | 90,000 | 40.17 | 100,000 | 44.64 | 110,000 | 49.10 | 120,000 | 53.57 |
| 250 | 100,000 | 44.64 | 112,500 | 50.22 | 125,000 | 55.80 | 137,500 | 61.38 | 150,000 | 66.86 |
| 300 | 120,000 | 53.57 | 135,000 | 60.26 | 150,000 | 66.86 | 165,000 | 73.68 | 180,000 | 80.35 |
| 400 | 160,000 | 71.42 | 180,000 | 80.35 | 200,000 | 89.28 | 220,000 | 98.20 | 240,000 | 107.15 |
| 500 | 200,000 | 89.28 | 225,000 | 100.44 | 250,000 | 111.60 | 275,000 | 122.76 | 300,000 | 133.92 |
| 600 | 240,000 | 107.15 | 250,000 | 111.60 | 300,000 | 133.92 | 330,000 | 147.32 | 360,000 | 160.71 |
| 700 | 280,000 | 125.00 | 315,000 | 140.62 | 360,000 | 158.25 | 395,000 | 171.80 | 420,000 | 187.50 |
| 800 | 320,000 | 142.85 | 360,000 | 160.71 | 400,000 | 178.52 | 440,000 | 191.91 | 480,000 | 214.30 |
| 900 | 360,000 | 160.71 | 405,000 | 180.89 | 450,000 | 200.89 | 495,000 | 220.91 | 540,000 | 241.07 |
| 1,000 | 400,000 | 178.52 | 450,000 | 200.89 | 500,000 | 223.20 | 550,000 | 245.53 | 600,000 | 267.85 |
| 1,500 | 600,000 | 267.85 | 675,000 | 301.33 | 750,000 | 334.80 | 825,000 | 368.30 | 900,000 | 401.78 |
| 2,000 | 800,000 | 357.14 | 900,000 | 401.78 | 1,000,000 | 446.42 | 1,100,000 | 491.07 | 1,200,000 | 535.71 |
| 3,000 | 1,200,000 | 535.71 | 1,350,000 | 602.66 | 1,500,000 | 669.64 | 1,650,000 | 736.60 | 1,800,000 | 803.57 |
| 4,000 | 1,600,000 | 714.28 | 1,800,000 | 803.57 | 2,000,000 | 892.85 | 2,200,000 | 982.14 | 2,400,000 | 1,071.42 |
| 5,000 | 2,000,000 | 892.85 | 2,250,000 | 1,004.46 | 2,500,000 | 1,116.07 | 2,750,000 | 1,227.67 | 3,000,000 | 1,339.28 |
| 7,500 | 3,000,000 | 1,339.28 | 3,375,000 | 1,508.69 | 3,750,000 | 1,674.10 | 4,125,000 | 1,841.51 | 4,500,000 | 2,008.92 |
| 10,000 | 4,000,000 | 1,785.71 | 4,500,000 | 2,008.92 | 5,000,000 | 2,232.14 | 5,500,000 | 2,455.35 | 6,000,000 | 2,678.57 |
| 25,000 | 10,000,000 | 4,464.28 | 11,250,000 | 5,022.32 | 12,500,000 | 5,580.35 | 13,750,000 | 6,138.34 | 15,000,000 | 6,698.42 |
| 50,000 | 20,000,000 | 8,928.57 | 22,500,000 | 10,044.64 | 25,000,000 | 11,160.71 | 27,500,000 | 12,276.78 | 30,000,000 | 13,392.85 |
| 100,000 | 40,000,000 | 17,857.14 | 45,000,000 | 20,089.28 | 50,000,000 | 22,321.42 | 55,000,000 | 24,553.57 | 60,000,000 | 26,785.70 |

If the exact acreage is not given above it can be computed by addition. Thus 6,660 acres are arrived at by adding 5,000 + 1,500 + 150 + 10.

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Table showing Percentage of Profit on Rubber Property at Varying Capital and Yields per Acre, and Varying Profits per lb.

| CAPITAL. | | | AT 1d. PROFIT PER LB. YIELD PER ACRE. | | | | | | | | | | CAPITAL. | | |
|----------------|----------------------------|----|--|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|----------------|----------------------------|----|
| Ster- ling. | In Rupees Exch. @ 1/4d. | | lb. 25 | lb. 50 | lb. 75 | lb. 100 | lb. 150 | lb. 200 | lb. 250 | lb. 300 | lb. 350 | lb. 400 | Ster- ling. | In Rupees Exch. @ 1/4d. | |
| 250 | 3753 | 00 | 04 | 08 | 12 | 16 | 25 | 33 | 41 | 50 | 58 | 66 | 250 | 3750 | 00 |
| 300 | 3000 | 00 | 05 | 10 | 15 | 20 | 31 | 41 | 52 | 62 | 73 | 83 | 300 | 3000 | 00 |
| 150 | 2250 | 00 | 06 | 13 | 20 | 27 | 42 | 55 | 69 | 83 | 97 | 111 | 150 | 2250 | 00 |
| 145 | 2175 | 00 | 07 | 14 | 21 | 28 | 43 | 57 | 71 | 86 | 100 | 114 | 145 | 2175 | 00 |
| 140 | 2100 | 00 | 07 | 14 | 22 | 29 | 44 | 59 | 74 | 89 | 104 | 119 | 140 | 2100 | 00 |
| 135 | 2025 | 00 | 07 | 15 | 23 | 30 | 46 | 61 | 77 | 92 | 108 | 123 | 135 | 2025 | 00 |
| 130 | 1950 | 00 | 08 | 16 | 24 | 32 | 48 | 64 | 80 | 96 | 112 | 128 | 130 | 1950 | 00 |
| 125 | 1875 | 00 | 08 | 16 | 25 | 33 | 50 | 66 | 83 | 100 | 116 | 133 | 125 | 1875 | 00 |
| 120 | 1800 | 00 | 09 | 17 | 26 | 34 | 52 | 69 | 86 | 104 | 121 | 138 | 120 | 1800 | 00 |
| 115 | 1725 | 00 | 09 | 18 | 27 | 36 | 54 | 72 | 90 | 108 | 126 | 145 | 115 | 1725 | 00 |
| 110 | 1650 | 00 | 09 | 18 | 28 | 37 | 56 | 75 | 93 | 113 | 132 | 151 | 110 | 1650 | 00 |
| 105 | 1575 | 00 | 09 | 19 | 29 | 39 | 59 | 79 | 99 | 119 | 140 | 158 | 105 | 1575 | 00 |
| 100 | 1500 | 00 | 10 | 21 | 31 | 43 | 62 | 83 | 104 | 125 | 145 | 163 | 100 | 1500 | 00 |
| 95 | 1425 | 00 | 10 | 21 | 31 | 43 | 66 | 87 | 109 | 131 | 153 | 175 | 95 | 1425 | 00 |
| 90 | 1350 | 00 | 11 | 23 | 34 | 46 | 69 | 92 | 115 | 139 | 162 | 185 | 90 | 1350 | 00 |
| 85 | 1275 | 00 | 12 | 24 | 36 | 49 | 73 | 98 | 122 | 147 | 171 | 196 | 85 | 1275 | 00 |
| 80 | 1200 | 00 | 13 | 26 | 39 | 52 | 78 | 104 | 130 | 156 | 182 | 208 | 80 | 1200 | 00 |
| 75 | 1125 | 00 | 13 | 27 | 41 | 55 | 83 | 111 | 138 | 166 | 194 | 222 | 75 | 1125 | 00 |
| 70 | 1050 | 00 | 14 | 29 | 44 | 59 | 88 | 119 | 148 | 178 | 208 | 238 | 70 | 1050 | 00 |
| 65 | 975 | 00 | 16 | 32 | 48 | 64 | 96 | 128 | 160 | 192 | 224 | 256 | 65 | 975 | 00 |
| 60 | 900 | 00 | 17 | 34 | 52 | 69 | 104 | 138 | 173 | 208 | 243 | 277 | 60 | 900 | 00 |
| 55 | 825 | 00 | 19 | 37 | 56 | 75 | 113 | 151 | 189 | 227 | 266 | 303 | 55 | 825 | 00 |
| 50 | 750 | 00 | 21 | 41 | 62 | 83 | 126 | 166 | 208 | 250 | 291 | 333 | 50 | 750 | 00 |
| 45 | 675 | 00 | 23 | 46 | 69 | 92 | 139 | 185 | 231 | 277 | 324 | 370 | 45 | 675 | 00 |
| 40 | 600 | 00 | 26 | 52 | 78 | 104 | 158 | 208 | 260 | 312 | 364 | 416 | 40 | 600 | 00 |
| 35 | 525 | 00 | 29 | 59 | 89 | 119 | 178 | 233 | 297 | 357 | 416 | 478 | 35 | 525 | 00 |
| 30 | 450 | 00 | 34 | 69 | 104 | 138 | 208 | 277 | 346 | 416 | 485 | 555 | 30 | 450 | 00 |
| 25 | 375 | 00 | 41 | 83 | 125 | 166 | 250 | 333 | 416 | 500 | 583 | 666 | 25 | 375 | 00 |
| 20 | 300 | 00 | 52 | 104 | 156 | 208 | 312 | 431 | 520 | 624 | 728 | 832 | 20 | 300 | 00 |

Table showing Percentage of Profit, &c.—(Continued.)

| Ster- ling. | CAPITAL. | | AT 20L PROFIT PER LB. YIELD PER ACRE. | | | | | | | | | | CAPITAL. | |
|----------------|----------------------------|----|--|-----|-----|-----|-----|-----|------|------|------|------|----------------|----------------------------|
| | In Rupees Exch. @sl/4d. | | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. | Ster- ling. | In Rupees Exch. @sl/4d. |
| | | | 25 | 50 | 75 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | | |
| 250 | 3750 | 00 | 08 | 16 | 25 | 33 | 50 | 66 | 83 | 100 | 116 | 133 | 250 | 3750 |
| 200 | 3000 | 00 | 10 | 21 | 31 | 41 | 62 | 83 | 104 | 125 | 145 | 166 | 200 | 3000 |
| 150 | 2250 | 00 | 13 | 27 | 42 | 55 | 83 | 111 | 138 | 166 | 194 | 222 | 150 | 2250 |
| 145 | 2175 | 00 | 14 | 28 | 43 | 57 | 86 | 114 | 143 | 172 | 201 | 229 | 145 | 2175 |
| 140 | 2100 | 00 | 14 | 29 | 44 | 59 | 89 | 119 | 148 | 178 | 208 | 238 | 140 | 2100 |
| 135 | 2025 | 00 | 15 | 30 | 46 | 61 | 92 | 123 | 154 | 185 | 216 | 248 | 135 | 2025 |
| 130 | 1950 | 00 | 16 | 32 | 48 | 64 | 96 | 128 | 160 | 192 | 224 | 256 | 130 | 1950 |
| 125 | 1875 | 00 | 16 | 33 | 50 | 66 | 100 | 133 | 166 | 200 | 233 | 266 | 125 | 1875 |
| 120 | 1800 | 00 | 17 | 34 | 52 | 69 | 104 | 138 | 173 | 208 | 243 | 277 | 120 | 1800 |
| 115 | 1725 | 00 | 18 | 36 | 54 | 72 | 108 | 145 | 181 | 217 | 253 | 289 | 115 | 1725 |
| 110 | 1650 | 00 | 19 | 37 | 56 | 75 | 113 | 151 | 189 | 227 | 265 | 303 | 110 | 1650 |
| 105 | 1575 | 00 | 19 | 39 | 59 | 79 | 119 | 158 | 198 | 238 | 277 | 317 | 105 | 1575 |
| 100 | 1500 | 00 | 21 | 41 | 62 | 83 | 125 | 166 | 208 | 250 | 291 | 333 | 100 | 1500 |
| 95 | 1425 | 00 | 21 | 43 | 65 | 87 | 131 | 175 | 218 | 262 | 306 | 350 | 95 | 1425 |
| 90 | 1350 | 00 | 23 | 46 | 69 | 92 | 139 | 185 | 231 | 277 | 324 | 370 | 90 | 1350 |
| 85 | 1275 | 00 | 24 | 49 | 73 | 98 | 147 | 196 | 245 | 294 | 343 | 392 | 85 | 1275 |
| 80 | 1200 | 00 | 26 | 52 | 78 | 104 | 156 | 208 | 260 | 312 | 364 | 416 | 80 | 1200 |
| 75 | 1125 | 00 | 27 | 55 | 83 | 111 | 166 | 222 | 277 | 333 | 388 | 444 | 75 | 1125 |
| 70 | 1050 | 00 | 29 | 59 | 89 | 119 | 178 | 238 | 297 | 357 | 416 | 476 | 70 | 1050 |
| 65 | 975 | 00 | 32 | 64 | 96 | 128 | 192 | 256 | 320 | 384 | 448 | 512 | 65 | 975 |
| 60 | 900 | 00 | 34 | 69 | 101 | 138 | 208 | 277 | 346 | 416 | 485 | 555 | 60 | 900 |
| 55 | 825 | 00 | 37 | 75 | 113 | 151 | 227 | 303 | 378 | 455 | 530 | 608 | 55 | 825 |
| 50 | 750 | 00 | 41 | 83 | 125 | 166 | 250 | 333 | 416 | 500 | 583 | 668 | 50 | 750 |
| 45 | 675 | 00 | 46 | 92 | 139 | 185 | 277 | 370 | 462 | 555 | 647 | 740 | 45 | 675 |
| 40 | 600 | 00 | 52 | 104 | 158 | 208 | 312 | 416 | 520 | 624 | 728 | 832 | 40 | 600 |
| 35 | 525 | 00 | 59 | 119 | 178 | 233 | 357 | 476 | 595 | 715 | 833 | 952 | 35 | 525 |
| 30 | 450 | 00 | 69 | 138 | 208 | 277 | 416 | 535 | 666 | 795 | 925 | 1055 | 30 | 450 |
| 25 | 375 | 00 | 83 | 166 | 250 | 333 | 500 | 666 | 833 | 1000 | 1166 | 1333 | 25 | 375 |
| 20 | 300 | 00 | 104 | 208 | 312 | 416 | 624 | 832 | 1040 | 1248 | 1456 | 1664 | 20 | 300 |

Table showing Percentage of Profit, &c.—(Continued.)

| CAPITAL. | | | AT 3d. PROFIT PER LB. YIELD PER ACRE. | | | | | | | | | | CAPITAL. | | |
|----------------|----------------------------|----|--|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|----------------|----------------------------|----|
| Ster- ling. | In Rupees Exch. @ 1/4d. | | lb. 25 | lb. 50 | lb. 75 | lb. 100 | lb. 150 | lb. 200 | lb. 250 | lb. 300 | lb. 350 | lb. 400 | Ster- ling. | In Rupees Exch. @ 1/4d. | |
| 250 | 3750 | 00 | 12 | 25 | 37 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 250 | 3750 | 00 |
| 300 | 3000 | 00 | 16 | 30 | 46 | 62 | 83 | 104 | 124 | 156 | 187 | 218 | 250 | 3000 | 00 |
| 150 | 2250 | 00 | 20 | 42 | 62 | 83 | 104 | 124 | 156 | 203 | 250 | 291 | 333 | 2250 | 00 |
| 145 | 2175 | 00 | 21 | 43 | 64 | 86 | 109 | 129 | 215 | 258 | 301 | 344 | 145 | 2175 | 00 |
| 140 | 2100 | 00 | 22 | 44 | 66 | 89 | 113 | 133 | 223 | 267 | 311 | 357 | 140 | 2100 | 00 |
| 135 | 2025 | 00 | 23 | 46 | 69 | 92 | 138 | 165 | 231 | 277 | 323 | 370 | 135 | 2025 | 00 |
| 130 | 1950 | 00 | 24 | 48 | 72 | 96 | 144 | 182 | 240 | 288 | 336 | 384 | 130 | 1950 | 00 |
| 125 | 1875 | 00 | 25 | 50 | 75 | 100 | 160 | 200 | 250 | 300 | 350 | 400 | 125 | 1875 | 00 |
| 120 | 1800 | 00 | 26 | 52 | 78 | 104 | 166 | 208 | 260 | 312 | 364 | 416 | 120 | 1800 | 00 |
| 115 | 1725 | 00 | 27 | 54 | 81 | 108 | 163 | 217 | 271 | 326 | 380 | 434 | 115 | 1725 | 00 |
| 110 | 1650 | 00 | 28 | 56 | 84 | 113 | 170 | 227 | 284 | 340 | 397 | 454 | 110 | 1650 | 00 |
| 105 | 1575 | 00 | 29 | 59 | 88 | 119 | 178 | 238 | 297 | 357 | 416 | 476 | 105 | 1575 | 00 |
| 100 | 1500 | 00 | 31 | 62 | 93 | 125 | 187 | 250 | 312 | 375 | 437 | 500 | 100 | 1500 | 00 |
| 95 | 1425 | 00 | 31 | 65 | 96 | 131 | 197 | 262 | 328 | 394 | 459 | 526 | 95 | 1425 | 00 |
| 90 | 1350 | 00 | 34 | 69 | 103 | 139 | 208 | 277 | 349 | 416 | 485 | 555 | 90 | 1350 | 00 |
| 85 | 1275 | 00 | 36 | 73 | 109 | 147 | 220 | 294 | 367 | 441 | 514 | 588 | 85 | 1275 | 00 |
| 80 | 1200 | 00 | 39 | 78 | 117 | 156 | 234 | 312 | 390 | 468 | 546 | 625 | 80 | 1200 | 00 |
| 75 | 1125 | 00 | 41 | 83 | 124 | 166 | 250 | 333 | 416 | 500 | 583 | 666 | 75 | 1125 | 00 |
| 70 | 1050 | 00 | 44 | 89 | 133 | 178 | 282 | 357 | 448 | 535 | 617 | 714 | 70 | 1050 | 00 |
| 65 | 975 | 00 | 48 | 98 | 144 | 192 | 298 | 384 | 480 | 576 | 672 | 769 | 65 | 975 | 00 |
| 60 | 900 | 00 | 52 | 104 | 156 | 208 | 312 | 416 | 520 | 625 | 728 | 833 | 60 | 900 | 00 |
| 55 | 825 | 00 | 58 | 113 | 169 | 227 | 340 | 455 | 568 | 681 | 795 | 909 | 55 | 825 | 00 |
| 50 | 750 | 00 | 62 | 123 | 187 | 250 | 375 | 500 | 625 | 750 | 875 | 1000 | 50 | 750 | 00 |
| 45 | 675 | 00 | 69 | 139 | 208 | 277 | 416 | 565 | 694 | 833 | 971 | 1111 | 45 | 675 | 00 |
| 40 | 600 | 00 | 78 | 156 | 234 | 312 | 468 | 624 | 721 | 833 | 952 | 1082 | 40 | 600 | 00 |
| 35 | 525 | 00 | 89 | 178 | 267 | 357 | 535 | 715 | 892 | 1071 | 1250 | 1430 | 35 | 525 | 00 |
| 30 | 450 | 00 | 104 | 208 | 312 | 416 | 625 | 832 | 1041 | 1250 | 1457 | 1666 | 30 | 450 | 00 |
| 25 | 375 | 00 | 125 | 250 | 375 | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | 25 | 375 | 00 |
| 20 | 300 | 00 | 156 | 312 | 468 | 624 | 937 | 1248 | 1562 | 1875 | 2185 | 2500 | 20 | 300 | 00 |

Table showing Percentage of Profit, &c.—(Continued.)

| CAPITAL. | | AT 6d. PROFIT PER LB. YIELD PER ACRE. | | | | | | | | | | CAPITAL. | |
|----------------|----------------------------|--|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|----------------|----------------------------|
| Ster- ling. | In Rupees Exch. @ 1/4d. | lb. 25 | lb. 50 | lb. 75 | lb. 100 | lb. 150 | lb. 200 | lb. 250 | lb. 300 | lb. 350 | lb. 400 | Ster- ling. | In Rupees Exch. @ 1/4d. |
| 250 | 3750 | 25 | 50 | 75 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 250 | 3750 |
| 300 | 3000 | 31 | 62 | 93 | 125 | 187 | 250 | 312 | 375 | 437 | 500 | 300 | 3000 |
| 150 | 2250 | 41 | 83 | 125 | 166 | 250 | 333 | 416 | 500 | 583 | 666 | 150 | 2250 |
| 145 | 2175 | 43 | 86 | 128 | 172 | 258 | 344 | 431 | 517 | 603 | 689 | 145 | 2175 |
| 140 | 2100 | 44 | 89 | 133 | 178 | 267 | 357 | 446 | 535 | 624 | 714 | 140 | 2100 |
| 135 | 2025 | 46 | 92 | 138 | 185 | 277 | 370 | 462 | 555 | 648 | 740 | 135 | 2025 |
| 130 | 1950 | 48 | 96 | 144 | 192 | 288 | 384 | 480 | 578 | 678 | 769 | 130 | 1950 |
| 125 | 1875 | 50 | 100 | 150 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 125 | 1875 |
| 120 | 1800 | 52 | 104 | 156 | 208 | 312 | 416 | 520 | 625 | 729 | 833 | 120 | 1800 |
| 115 | 1725 | 54 | 108 | 163 | 217 | 326 | 434 | 543 | 652 | 756 | 869 | 115 | 1725 |
| 110 | 1650 | 57 | 113 | 170 | 227 | 340 | 454 | 568 | 681 | 795 | 909 | 110 | 1650 |
| 105 | 1575 | 59 | 119 | 178 | 238 | 357 | 476 | 595 | 714 | 833 | 952 | 105 | 1575 |
| 100 | 1500 | 62 | 125 | 187 | 250 | 375 | 500 | 625 | 750 | 875 | 1000 | 100 | 1500 |
| 95 | 1425 | 66 | 131 | 197 | 263 | 394 | 526 | 657 | 789 | 921 | 1052 | 95 | 1425 |
| 90 | 1350 | 69 | 138 | 208 | 277 | 416 | 555 | 698 | 833 | 972 | 1111 | 90 | 1350 |
| 85 | 1275 | 73 | 147 | 220 | 294 | 441 | 588 | 735 | 882 | 1029 | 1176 | 85 | 1275 |
| 80 | 1200 | 78 | 156 | 234 | 312 | 468 | 625 | 781 | 937 | 1093 | 1250 | 80 | 1200 |
| 75 | 1125 | 83 | 166 | 250 | 333 | 500 | 666 | 833 | 1000 | 1166 | 1333 | 75 | 1125 |
| 70 | 1050 | 89 | 178 | 267 | 357 | 535 | 714 | 892 | 1071 | 1249 | 1428 | 70 | 1050 |
| 65 | 975 | 96 | 189 | 288 | 384 | 576 | 769 | 961 | 1153 | 1346 | 1538 | 65 | 975 |
| 60 | 900 | 104 | 209 | 312 | 416 | 625 | 833 | 1041 | 1250 | 1458 | 1666 | 60 | 900 |
| 55 | 825 | 113 | 227 | 340 | 454 | 681 | 909 | 1136 | 1363 | 1590 | 1818 | 55 | 825 |
| 50 | 750 | 125 | 250 | 375 | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | 50 | 750 |
| 45 | 675 | 136 | 277 | 418 | 555 | 833 | 1111 | 1388 | 1666 | 1944 | 2222 | 45 | 675 |
| 40 | 600 | 156 | 312 | 468 | 625 | 937 | 1250 | 1562 | 1876 | 2190 | 2504 | 40 | 600 |
| 35 | 525 | 178 | 357 | 535 | 714 | 1071 | 1428 | 1784 | 2142 | 2500 | 2857 | 35 | 525 |
| 30 | 450 | 208 | 416 | 625 | 833 | 1250 | 1666 | 2082 | 2500 | 2916 | 3333 | 30 | 450 |
| 25 | 375 | 250 | 500 | 750 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 25 | 375 |
| 20 | 300 | 312 | 625 | 937 | 1250 | 1875 | 2500 | 3125 | 3750 | 4375 | 5000 | 20 | 300 |

Table showing Percentage of Profit, &c. — (Continued.)

| CAPITAL. | | | AT 1s. PROFIT PER LB. YIELD PER ACRE. | | | | | | | | | | CAPITAL. | | |
|----------------|-----------------------------|----|--|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|----------------|-----------------------------|----|
| Ster- ling. | In Rupees Exch. @s/1/4d. | | lb. 25 | lb. 50 | lb. 75 | lb. 100 | lb. 150 | lb. 200 | lb. 250 | lb. 300 | lb. 350 | lb. 400 | Ster- ling. | In Rupees Exch. @s/1/4d. | |
| 250 | 3750 | 00 | 50 | 100 | 150 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 250 | 3750 | 00 |
| 200 | 3000 | 00 | 42 | 82 | 125 | 167 | 250 | 333 | 417 | 500 | 583 | 667 | 200 | 3000 | 00 |
| 150 | 2250 | 00 | 32 | 62 | 92 | 122 | 183 | 244 | 306 | 367 | 428 | 489 | 150 | 2250 | 00 |
| 145 | 2175 | 00 | 31 | 61 | 91 | 121 | 181 | 241 | 302 | 363 | 424 | 485 | 145 | 2175 | 00 |
| 140 | 2100 | 00 | 30 | 60 | 90 | 120 | 180 | 240 | 300 | 360 | 420 | 480 | 140 | 2100 | 00 |
| 135 | 2025 | 00 | 29 | 58 | 87 | 117 | 177 | 237 | 297 | 357 | 417 | 477 | 135 | 2025 | 00 |
| 130 | 1950 | 00 | 28 | 56 | 84 | 112 | 172 | 232 | 292 | 352 | 412 | 472 | 130 | 1950 | 00 |
| 125 | 1875 | 00 | 27 | 54 | 81 | 110 | 169 | 229 | 289 | 349 | 409 | 469 | 125 | 1875 | 00 |
| 120 | 1800 | 00 | 26 | 52 | 78 | 107 | 164 | 224 | 284 | 344 | 404 | 464 | 120 | 1800 | 00 |
| 115 | 1725 | 00 | 25 | 50 | 75 | 103 | 159 | 219 | 279 | 339 | 399 | 459 | 115 | 1725 | 00 |
| 110 | 1650 | 00 | 24 | 48 | 72 | 100 | 154 | 214 | 274 | 334 | 394 | 454 | 110 | 1650 | 00 |
| 105 | 1575 | 00 | 23 | 46 | 69 | 97 | 148 | 208 | 268 | 328 | 388 | 448 | 105 | 1575 | 00 |
| 100 | 1500 | 00 | 22 | 44 | 66 | 93 | 143 | 203 | 263 | 323 | 383 | 443 | 100 | 1500 | 00 |
| 95 | 1425 | 00 | 21 | 42 | 63 | 89 | 138 | 198 | 258 | 318 | 378 | 438 | 95 | 1425 | 00 |
| 90 | 1350 | 00 | 20 | 40 | 60 | 85 | 133 | 193 | 253 | 313 | 373 | 433 | 90 | 1350 | 00 |
| 85 | 1275 | 00 | 19 | 38 | 57 | 81 | 128 | 188 | 248 | 308 | 368 | 428 | 85 | 1275 | 00 |
| 80 | 1200 | 00 | 18 | 36 | 54 | 77 | 123 | 183 | 243 | 303 | 363 | 423 | 80 | 1200 | 00 |
| 75 | 1125 | 00 | 17 | 34 | 51 | 73 | 118 | 178 | 238 | 298 | 358 | 418 | 75 | 1125 | 00 |
| 70 | 1050 | 00 | 16 | 32 | 48 | 69 | 113 | 173 | 233 | 293 | 353 | 413 | 70 | 1050 | 00 |
| 65 | 975 | 00 | 15 | 30 | 45 | 65 | 108 | 168 | 228 | 288 | 348 | 408 | 65 | 975 | 00 |
| 60 | 900 | 00 | 14 | 28 | 42 | 61 | 103 | 163 | 223 | 283 | 343 | 403 | 60 | 900 | 00 |
| 55 | 825 | 00 | 13 | 26 | 39 | 57 | 98 | 158 | 218 | 278 | 338 | 398 | 55 | 825 | 00 |
| 50 | 750 | 00 | 12 | 24 | 36 | 53 | 93 | 153 | 213 | 273 | 333 | 393 | 50 | 750 | 00 |
| 45 | 675 | 00 | 11 | 22 | 33 | 49 | 88 | 148 | 208 | 268 | 328 | 388 | 45 | 675 | 00 |
| 40 | 600 | 00 | 10 | 20 | 30 | 45 | 83 | 143 | 203 | 263 | 323 | 383 | 40 | 600 | 00 |
| 35 | 525 | 00 | 9 | 18 | 27 | 41 | 78 | 138 | 198 | 258 | 318 | 378 | 35 | 525 | 00 |
| 30 | 450 | 00 | 8 | 16 | 24 | 37 | 73 | 133 | 193 | 253 | 313 | 373 | 30 | 450 | 00 |
| 25 | 375 | 00 | 7 | 14 | 20 | 33 | 68 | 128 | 188 | 248 | 308 | 368 | 25 | 375 | 00 |
| 20 | 300 | 00 | 6 | 12 | 18 | 27 | 63 | 123 | 183 | 243 | 303 | 363 | 20 | 300 | 00 |

Table showing Percentage of Profit, &c. - (Continued.)

| CAPITAL. | | | At 1s. 6d. Profit per lb. | | | | | | | | | | CAPITAL. | | |
|------------|-------------------------|----|---------------------------|--------|--------|---------|---------|---------|---------|---------|---------|---------|------------|-------------------------|----|
| Ster-ling. | In Rupees Exch. @ 1/4d. | 0 | YIELD PER ACRE. | | | | | | | | | | Ster-ling. | In Rupees Exch. @ 1/4d. | 0 |
| | | | lb. 25 | lb. 50 | lb. 75 | lb. 100 | lb. 150 | lb. 200 | lb. 250 | lb. 300 | lb. 350 | lb. 400 | | | |
| 250 | 3750 | 00 | 75 | 150 | 225 | 300 | 450 | 600 | 750 | 900 | 1050 | 1200 | 250 | 3750 | 00 |
| 200 | 3000 | 00 | 93 | 187 | 281 | 375 | 562 | 750 | 937 | 1125 | 1312 | 1500 | 200 | 3000 | 00 |
| 150 | 2250 | 00 | 125 | 250 | 375 | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | 150 | 2250 | 00 |
| 145 | 2175 | 00 | 128 | 258 | 387 | 517 | 775 | 1034 | 1292 | 1550 | 1809 | 2068 | 145 | 2175 | 00 |
| 140 | 2100 | 00 | 133 | 267 | 401 | 535 | 803 | 1071 | 1339 | 1607 | 1875 | 2143 | 140 | 2100 | 00 |
| 135 | 2025 | 00 | 138 | 277 | 416 | 555 | 833 | 1111 | 1388 | 1666 | 1944 | 2222 | 135 | 2025 | 00 |
| 130 | 1950 | 00 | 144 | 288 | 432 | 577 | 865 | 1153 | 1442 | 1730 | 2018 | 2307 | 130 | 1950 | 00 |
| 125 | 1875 | 00 | 150 | 300 | 450 | 600 | 900 | 1200 | 1500 | 1800 | 2100 | 2400 | 125 | 1875 | 00 |
| 120 | 1800 | 00 | 156 | 312 | 468 | 625 | 937 | 1250 | 1562 | 1875 | 2187 | 2500 | 120 | 1800 | 00 |
| 115 | 1725 | 00 | 163 | 326 | 489 | 652 | 978 | 1304 | 1630 | 1956 | 2282 | 2608 | 115 | 1725 | 00 |
| 110 | 1650 | 00 | 170 | 341 | 511 | 682 | 1023 | 1363 | 1704 | 2045 | 2386 | 2727 | 110 | 1650 | 00 |
| 105 | 1575 | 00 | 178 | 357 | 535 | 714 | 1071 | 1429 | 1785 | 2142 | 2500 | 2857 | 105 | 1575 | 00 |
| 100 | 1500 | 00 | 187 | 375 | 562 | 750 | 1121 | 1500 | 1875 | 2250 | 2625 | 3000 | 100 | 1500 | 00 |
| 95 | 1425 | 00 | 197 | 394 | 592 | 789 | 1184 | 1579 | 1973 | 2368 | 2763 | 3157 | 95 | 1425 | 00 |
| 90 | 1350 | 00 | 208 | 416 | 624 | 833 | 1249 | 1666 | 2082 | 2499 | 2915 | 3333 | 90 | 1350 | 00 |
| 85 | 1275 | 00 | 220 | 441 | 661 | 882 | 1323 | 1764 | 2205 | 2646 | 3087 | 3528 | 85 | 1275 | 00 |
| 80 | 1200 | 00 | 234 | 468 | 703 | 937 | 1406 | 1875 | 2343 | 2812 | 3281 | 3750 | 80 | 1200 | 00 |
| 75 | 1125 | 00 | 250 | 500 | 750 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 75 | 1125 | 00 |
| 70 | 1050 | 00 | 267 | 535 | 800 | 1071 | 1607 | 2143 | 2678 | 3214 | 3750 | 4286 | 70 | 1050 | 00 |
| 65 | 975 | 00 | 288 | 576 | 865 | 1153 | 1737 | 2307 | 2884 | 3461 | 4037 | 4614 | 65 | 975 | 00 |
| 60 | 900 | 00 | 318 | 625 | 937 | 1250 | 1875 | 2500 | 3125 | 3750 | 4375 | 5000 | 60 | 900 | 00 |
| 55 | 825 | 00 | 340 | 681 | 1022 | 1363 | 2045 | 2726 | 3407 | 4088 | 4771 | 5453 | 55 | 825 | 00 |
| 50 | 750 | 00 | 375 | 750 | 1125 | 1500 | 2250 | 3000 | 3750 | 4500 | 5250 | 6000 | 50 | 750 | 00 |
| 45 | 675 | 00 | 416 | 833 | 1250 | 1666 | 2499 | 3332 | 4165 | 4998 | 5831 | 6664 | 45 | 675 | 00 |
| 40 | 600 | 00 | 468 | 937 | 1406 | 1875 | 2812 | 3750 | 4687 | 5625 | 6562 | 7500 | 40 | 600 | 00 |
| 35 | 525 | 00 | 535 | 1071 | 1607 | 2143 | 3214 | 4286 | 5357 | 6429 | 7500 | 8572 | 35 | 525 | 00 |
| 30 | 450 | 00 | 625 | 1250 | 1875 | 2500 | 3750 | 5000 | 6250 | 7500 | 8750 | 10000 | 30 | 450 | 00 |
| 25 | 375 | 00 | 750 | 1500 | 2250 | 3000 | 4500 | 6000 | 7500 | 9000 | 10500 | 12000 | 25 | 375 | 00 |
| 20 | 300 | 00 | 937 | 1875 | 2812 | 3750 | 5625 | 7500 | 9375 | 11250 | 13125 | 15000 | 20 | 300 | 00 |

Table showing Percentage of Profit, &c.—(Continued.)

| CAPITAL. | | AT 2s. PROFIT PER LB. | | | | | | | | | | CAPITAL. | | | |
|----------------|------|----------------------------|-------|-----------------|-----------|-----------|------------|------------|-------------|------------|------------|----------------|------|----------------------------|----|
| Ster- ling. | | In Rupees Exch. @ 1/4d. | | YIELD PER ACRE. | | | | | | | | Ster- ling. | | In Rupees Exch. @ 1/4d. | |
| | | | | lb. 25 | lb. 50 | lb. 75 | lb. 100 | lb. 150 | lb. 200. | lb. 250 | lb. 300 |  |  |  |  | lb. 350. | lb. 400 |
| 250 | 3750 | 1-00 | 2-00 | 3-00 | 4-00 | 6-00 | 8-00 | 10-00 | 12-00 | 14-00 | 16-00 | 250 | 3750 | 00 | 00 |
| 200 | 3000 | 1-25 | 2-50 | 3-75 | 5-00 | 7-50 | 10-00 | 12-50 | 15-00 | 17-50 | 20-00 | 200 | 3000 | 00 | 00 |
| 150 | 2250 | 1-66 | 3-33 | 5-00 | 6-66 | 10-00 | 13-33 | 16-66 | 20-00 | 23-33 | 26-66 | 150 | 2250 | 00 | 00 |
| 145 | 2175 | 1-72 | 3-44 | 5-17 | 6-89 | 10-34 | 13-79 | 17-23 | 20-68 | 24-13 | 27-50 | 145 | 2175 | 00 | 00 |
| 140 | 2100 | 1-78 | 3-57 | 5-35 | 7-17 | 10-71 | 14-18 | 17-85 | 21-42 | 24-99 | 28-56 | 140 | 2100 | 00 | 00 |
| 135 | 2025 | 1-86 | 3-70 | 5-56 | 7-40 | 11-11 | 14-81 | 18-51 | 22-22 | 25-92 | 29-62 | 135 | 2025 | 00 | 00 |
| 130 | 1950 | 1-92 | 3-84 | 5-76 | 7-69 | 11-53 | 15-38 | 19-23 | 23-07 | 26-91 | 30-77 | 130 | 1950 | 00 | 00 |
| 125 | 1875 | 2-00 | 4-00 | 6-00 | 8-00 | 12-00 | 16-00 | 20-00 | 24-00 | 28-00 | 32-00 | 125 | 1875 | 00 | 00 |
| 120 | 1800 | 2-08 | 4-16 | 6-25 | 8-33 | 12-50 | 16-66 | 20-83 | 25-00 | 29-16 | 33-33 | 120 | 1800 | 00 | 00 |
| 115 | 1725 | 2-17 | 4-34 | 6-52 | 8-69 | 13-04 | 17-39 | 21-73 | 26-08 | 30-43 | 34-78 | 115 | 1725 | 00 | 00 |
| 110 | 1650 | 2-27 | 4-54 | 6-81 | 9-09 | 13-63 | 18-18 | 22-72 | 27-26 | 31-81 | 36-36 | 110 | 1650 | 00 | 00 |
| 105 | 1575 | 2-38 | 4-76 | 7-14 | 9-52 | 14-28 | 19-05 | 23-80 | 28-57 | 33-33 | 38-09 | 105 | 1575 | 00 | 00 |
| 100 | 1500 | 2-50 | 5-00 | 7-50 | 10-00 | 15-00 | 20-00 | 25-00 | 30-00 | 35-00 | 40-00 | 100 | 1500 | 00 | 00 |
| 95 | 1425 | 2-63 | 5-26 | 7-89 | 10-52 | 15-79 | 21-05 | 26-31 | 31-57 | 36-83 | 42-09 | 95 | 1425 | 00 | 00 |
| 90 | 1350 | 2-77 | 5-55 | 8-33 | 11-11 | 16-67 | 22-22 | 27-78 | 33-34 | 38-89 | 44-44 | 90 | 1350 | 00 | 00 |
| 85 | 1275 | 2-94 | 5-98 | 8-82 | 11-76 | 17-64 | 23-52 | 29-40 | 35-28 | 41-16 | 47-04 | 85 | 1275 | 00 | 00 |
| 80 | 1200 | 3-12 | 6-25 | 9-37 | 12-50 | 18-75 | 25-00 | 31-25 | 37-50 | 43-75 | 50-00 | 80 | 1200 | 00 | 00 |
| 75 | 1125 | 3-33 | 6-66 | 10-00 | 13-13 | 20-00 | 26-66 | 33-33 | 40-00 | 46-66 | 53-33 | 75 | 1125 | 00 | 00 |
| 70 | 1050 | 3-57 | 7-14 | 10-71 | 14-28 | 21-42 | 28-57 | 35-71 | 42-85 | 49-99 | 57-14 | 70 | 1050 | 00 | 00 |
| 65 | 975 | 3-84 | 7-69 | 11-53 | 15-38 | 23-07 | 30-77 | 38-46 | 46-15 | 53-84 | 61-54 | 65 | 975 | 00 | 00 |
| 60 | 900 | 4-18 | 8-33 | 12-50 | 16-66 | 25-00 | 33-33 | 41-66 | 50-00 | 58-33 | 66-66 | 60 | 900 | 00 | 00 |
| 55 | 825 | 4-54 | 9-09 | 13-63 | 18-18 | 27-27 | 36-36 | 45-45 | 54-54 | 63-63 | 72-72 | 55 | 825 | 00 | 00 |
| 50 | 750 | 5-00 | 10-00 | 15-00 | 20-00 | 30-00 | 40-00 | 50-00 | 60-00 | 70-70 | 80-00 | 50 | 750 | 00 | 00 |
| 45 | 675 | 5-55 | 11-11 | 16-66 | 22-22 | 33-33 | 44-44 | 55-55 | 66-66 | 77-77 | 88-88 | 45 | 675 | 00 | 00 |
| 40 | 600 | 6-25 | 12-50 | 18-75 | 25-00 | 37-50 | 50-00 | 62-50 | 75-00 | 87-50 | 100-00 | 40 | 600 | 00 | 00 |
| 35 | 525 | 7-14 | 14-28 | 21-42 | 28-57 | 42-85 | 57-14 | 71-42 | 85-71 | 100-00 | 114-28 | 35 | 525 | 00 | 00 |
| 30 | 450 | 8-33 | 16-66 | 25-00 | 33-33 | 50-00 | 66-66 | 83-33 | 100-00 | 116-66 | 133-33 | 30 | 450 | 00 | 00 |
| 25 | 375 | 10-00 | 20-00 | 30-00 | 40-00 | 60-00 | 80-00 | 100-00 | 120-00 | 140-00 | 160-00 | 25 | 375 | 00 | 00 |
| 20 | 300 | 12-50 | 25-00 | 37-50 | 50-00 | 75-00 | 100-00 | 125-00 | 150-00 | 175-00 | 200-00 | 20 | 300 | 00 | 00 |

FUNGOID SPOT DISEASE IN PREPARED RUBBER.

Traced to latex infected in the Field.

Takes 5 to 7 days to shew its presence by excretory colouring matter. Moisture is necessary for its life. Spores can be carried by air from an infected piece of nearly dry rubber to wet rubber. Dry rubber cannot be affected.

Remedies:—In drying store where disease is rampant:—50% solution Formalin sprayed over woodwork inside store, close house and seal it for a day or two; or, well close up drying room, burn sulphur for 24 hours at about 2 lbs. per 1,000 c. ft. of space. Previous to this all woodwork should be made thoroughly wet to favour formation of sulphuric acid.

Also use smoke-house as isolation chamber for affected Rubber.

Also periodical time washing of drying shed and new racks.

Chances of infection greater in wooden drying shed than in one of iron and wood.

Presence of moisture in drying shed must be avoided.

Where crepe is to be made in a district liable to Fungoid Spot Disease only *thin* crepe should be made and should be finished only on a smooth roller.

If all remedies fail, then supersede the ordinary drying process by some system of quick firing.

Sodium Bisulphite, Making Crepe.—The proportions found satisfactory for mixing with the latex are 8 oz. of Sodium Bisulphite to 90 gallons latex. This hastens the drying.

Latex in contact with iron or coagulum with iron should not be permitted. See that all tin-coated vessels are perfect.

Air Bubbles.—Causes.—Use of extremely rich latex. Remedy: dilute latex with water about half to an equal volume.

Latex should not be allowed to stand long before coagulation.

Over strong solutions of acetic acid cause air bubbles. Solutions should vary from 5% down to 0.5%.

Vacuum Dryer.—When new its trial runs should shew 28 inches vacuum pressure, otherwise it should not be taken over by the estate manager.

When the last 3 or 4% of moisture is removed temperature mounts up rapidly and may be as high as 190 F when Chamber is opened. If this is so the vacuum is not being maintained.

To obviate this steam should not be admitted to the pipes, which heat the Chamber for 10 minutes or quarter of an hour, and attention paid to maintenance of as high a vacuum as possible.

The more inefficient the working of the vacuum pump, or the more slipshod the general fitting, the higher the temperature of the Chamber will be for any reasonable steam pressure in the interior pipes.

H. K. R.

EXTRACTS FROM MEMORANDA BY MESSRS. FIGGIS & Co.

(45, Fenchurch Street, London, E.C.)

Rubber should be washed as clean as possible, and very small lots of different descriptions are not liked. Lots of under 4 cwts. are sold as "star lots" at the end of the auctions.

The cases should be strong, 1 to 2 cwts. seem regular sizes, but perhaps double that size may be found suitable as quantities increase.

No paper or fullers earth should be used. Cotton adhering to rubber from the presser, is very much objected to and depreciates value.

The cases should be planed smooth inside, to avoid small pieces of wood adhering to the Rubber.

EXTRACTS FROM MEMORANDA BY MESSRS. LEWIS & FEAT

(6, Mincing Lane, London, E.C.)

Sheets should be ribbed, thereby allowing a free passage of air on the voyage.

Highlands and Lowlands may be taken as the best example of Smoked Sheets and Rosehaugh of Blanket Crepe, but many other marks run these two very close.

The aim is to produce rubber containing the smallest quantity of foreign matter and coagulants of all descriptions should be used with the utmost care, and the smallest quantity sufficient to bring about a satisfactory coagulation used. Excessive use of Acid in coagulation generally results in a weak and a very often unsightly sample.

It has been generally noted that Sheet rubber that has been made by heavy machinery is very superior to that made by the old hand rollers or mangle.

In smoking the Sheet rubber, care should be taken that the sheets are all thoroughly and evenly smoked, and above all, great care should be taken that the smokehouse should not be allowed to become too hot, which results in the charring or scorching of the rubber.

A good deal of money has been lost through the Scrap and Bark grades not being sufficiently washed, the presence of small pieces of wood or bark making a difference in value of pence per lb.

It has been noticed that several samples coming forward have contained small pieces of cotton; this is apparently caused by pieces of cotton waste becoming mixed with the rubber and getting rolled in.

Crepe rubber is continually coming forward showing stains down the edges caused by oil exuding from the bearings of the machines.

In choosing a case for packing rubber the main points to be considered are strength, lightness, and above all that the inside surface of the chest be planed absolutely smooth to avoid the adhesion of splinters to the contents. A case may be rough outside but on no account rough inside.

The size most commonly used is $19 \times 19 \times 24$ inches, 10 of these exactly making 1 Shipping Ton of 50 cubic feet; Rubber being shipped by the measured ton, this size is most convenient.

However, now that large crepeing machines are being used it is somewhat difficult to fit the broad Crepe into the above sized chest, and many estates are using a "Venesta" $21 \times 21 \times 24$, which exactly takes two widths of the broad Crepe.

The marking of the cases should be done with the utmost care, the gross and nett weights being clearly stencilled on the cases, and when a mark has once been settled upon it is advisable to adhere to it, as buyers, if they find a mark that suits them will always look for it again, and are often willing to improve their bids to secure stuff they have used before and they know will give them satisfaction. When dealing with Smoked Varieties it is advisable to mark the case clearly with the word "Smoked."

In selling rubber in London, Planters and Shippers have the following advantages:—The rubber is sold by the public auction and all grades are competed by the British, Continental and American buyers, the lower grades fetching their respective values. The samples are drawn by dock and wharf officials and fairness thereby assured. The same may be said of weights, which are scrupulously taken and shippers' interests protected. To minimise loss in weight after giving out small samples to the Trade to get orders the remainder of the samples drawn for the auctions is returned to the cases, and beyond the merchant's commission and the $\frac{1}{2}$ per cent. brokerage, no intermediate profit is made, and the competition and the conduct of the London auction is recognized as being absolutely straightforward and honest.

EXPORT DUTIES ON RUBBER.

| | | | |
|-------------------|-------------------|-------------------------|---------------------------|
| F. M. S. | cultivated rubber | — | 2½% ad. val. |
| " | Para rubber latex | except Pahang | 2½% " " |
| " | Gutta percha | grown on alienated land | 2½% " " |
| " | do | otherwise | 80% " " |
| B. N. Borneo | cultivated | — | free |
| " | wild | — | 10% ad. val. |
| " | gutta percha | red and white | 10% " " |
| Sarawak | indiarubber | — | \$10 per picul |
| " | gutta jelutong | — | \$1 " " |
| " | " Jangkar | — | \$1.50, " " |
| " | " all other | — | \$10 " " |
| Zanzibar | rubber | — | 15% ad. val. |
| N. F. Rhodesia | wild rubber | — | 4d. per lb. |
| Nyassaland | " " | — | 9d. " " |
| Uganda & B. E. A. | " " | — | 10% ad. val. |
| British Guiana | rubber and balata | from Crown lands | 2 cents per lb. (royalty) |

STANDARDISATION OF QUALITY AND GRADING.

Every effort must be made by Planters to ship their rubber as *uniform as possible in quality, and to maintain an even grading.* In this way it will be possible to deal with a much larger proportion of the crops by private treaty for near and future delivery, thus keeping the Auctions within reasonable bounds. Visiting Agents and Managers generally would be well advised to bear in mind the great importance of this standardising and grading on all estates.

The large amount of supervision (preferably European) required in the Factory to maintain efficiency does not appear to have been sufficiently appreciated in the past, and many estates have been rather too

much inclined to await the development of some possible new process before installing adequate machinery, which would most probably be required in the future whatever new methods might come into use.

The smoking process has many points to recommend it, especially as regards the strength and durability of rubber so treated. Up to the present this particular preparation has been a more cumbersome one and has taken a considerably longer time than that of crepe. Also unless the smoking and drying have been very carefully and thoroughly carried out the rubber is sometimes liable to arrive in a moist and mouldy condition.

SORTING AND PACKING.

Another point which might well receive more attention in the Factory is the sorting and packing of the rubber. In view of the considerable part of the crop which is now delivered on Forward contracts, the rubber must be even and the better qualities free from all traces of heat and oil damage, *and on no account should stained or streaky rubber be packed in the same cases as the best.* A large amount of time and expense are involved if rubber has to be restored in the London warehouses, owing to the presence of these defects.

Small lots of odd qualities should be retained as far as possible in the Factory until merchantable breaks of say three or four packages can be sent forward.

We still hear complaints of rough cases being used. The insides of the packages must be well planed and smooth, so that the rubber shall arrive free from saw-dust, chips of wood, etc. Care must be taken to see that both cases and rubber are thoroughly dry before packing.

APPROXIMATE COST OF RUBBER F.O.B. PER LB. AT VARYING YIELDS WITH AND WITHOUT MANURING.

Manuring has been taken at Rs. 55 per acre for half the acreage annually.

| Yields per acre. | | With Manuring. | | Without Manuring. |
|------------------|-----|----------------|-----|-------------------|
| lbs. | | Cts. | | Cts. |
| 180 | ... | 80 | ... | 65 |
| 200 | ... | 76 | ... | 61 |
| 230 | ... | 68 | ... | 56 |
| 250 | ... | 63 | ... | 52 |
| 300 | ... | 57 | ... | 48 |

THE RUBBER GROWERS' ASSOCIATION (INCORPORATED).

**RECOMMENDATIONS FOR THE TREATMENT OF LATEX AND CURING
OF RUBBER.**

Compiled by the Uniformity Committee from information supplied by the
Scientific Staff.

GENERAL.**Cups, Buckets, and other Utensils**

should be selected with a view to ease in cleaning and should be kept absolutely clean. Vessels made of copper, or any alloy of copper, and kerosene tins or receptacles with similar angles should be avoided.

Water in Cups.

In most cases addition of water is quite unnecessary. A little clean water may be used in very dry weather, when the latex tends to coagulate very quickly. In some instances a little formalin or sodium sulphite (not bisulphite) may be added, *but application should be first made to the laboratory for advice before using these reagents.*

Water on the Transverse Cuts

is not advisable. Often the latex coagulates as a result of employing water on fresh cuts.

Bark Shavings

and other impurities should not be allowed in the cups or buckets.

Collection of Latex.

Latex should not be allowed to stand in the field. The earliest opportunity for collection should be taken. It is recommended that in collecting, the following grades be recognised and kept separate:

- (a) Clean uncoagulated latex;
- (b) Lump, coagulated in the cups;
- (c) Rinsings from the cups.

Transport of Latex.

Every possible means of facilitating quick transport should be taken. When distance of transport is great, outstation coagulating houses should be erected.

IN THE FACTORY.

RECEPTION OF LATEX.

Preliminary Treatment.

The latex should be received if possible on a verandah, so that there is no necessity for coolies to enter the building, thus avoiding the presence of dirt in the factory.

Supervision.

The reception of latex should be under direct European supervision. Causes of defects in preparation of the finished rubber are thus often detected.

Cleanliness

in utensils and methods is absolutely necessary; any neglect in this respect is sure to detract from the quality of the rubber.

Straining of Latex

should be thorough, care being taken to see that the mesh is in good order.

Bulking of Latex

is strongly recommended. The mixing of all latex undoubtedly tends to produce a rubber of greater uniformity.

Sodium Bisulphite.

For crepe manufacture dissolve $\frac{1}{2}$ lb. of the powder in 1 gallon of water. This will be sufficient for 40 gallons of undiluted latex. The solution should be well stirred in after bulking and before the addition of acid. Larger quantities of Sodium Bisulphite are quite unnecessary. Sodium Bisulphite should not be used in making sheet rubber.

NOTE.—Latex containing more than 35% of rubber may be taken as “undiluted latex.”

COAGULATION.

Coagulant.

Acetic acid is recommended as the best coagulant at present.

Strength of Solution.

Stock solutions should be made up as follows:—

For Making Crepe.

- (a) Take one part of concentrated acetic acid, of 98 to 100 per cent. strength, and dilute it with 20 parts of pure water.

For Making Sheet.

- (b) Take one part of concentrated acid, of 98 to 100 per cent. strength, and dilute it with 200 parts of pure water.

If in making these stock solutions a more diluted acid be employed such as an acid of 80 per cent. strength, a proportionately greater amount of acid must be taken: thus with an 80 per cent. acid, $1\frac{1}{4}$ parts must be taken instead of one part.

In effecting coagulation the maximum amounts of these stock solutions, which need never be exceeded, are:—

For Crepe.

- (a) 1 part of stock solution to 50 parts of undiluted latex.

For Sheet.

- (b) 1 part of stock solution to 5 parts of undiluted latex.

It will frequently be found that less than these amounts is enough to produce complete coagulation, and the minimum amount which is effective should be ascertained by trial.

If the latex has been diluted, a proportionate reduction in the amount of the coagulant may be made: thus if 50 gallons of pure latex have been diluted up to 100 gallons by adding water, then only one part of stock solution (a) need be used for 100 parts of such diluted latex.

Mixing

of acid and latex should be thorough. This is best effected by means of broad wooden paddles. Sticks must not be allowed for this purpose. When making sheet the scum should be removed and added to the lumps:

- (a) For the preparation of crepe rubber or sheet rubber in coagulating tanks any quantity of latex may be coagulated in bulk;
- (b) For sheet rubber, when ordinary dishes are used, not more than 50 gallons of latex should be treated with acid in one batch, as the latex sometimes coagulates before all can be poured out into the dishes. It is sometimes expedient to add water to the latex or to use a diluted solution of formalin to prevent rapid coagulation. *In such cases advice should be obtained from the laboratory*

PREPARATION OF RUBBER.**Amount of Working.**

The extent to which rubber is worked on the machines should be the minimum found necessary.

The Thickness of the Rubber

determines the rate of drying. Pale crepe should be rolled out thin for drying, especially thin for artificial drying, and this can subsequently be worked into blanket crepe if desired. Sheet rubber when dry should not exceed $\frac{1}{8}$ in. in thickness.

Smoke Curing.

Sheets should always be as uniform in thickness as possible and the period of smoke curing should also be uniform. Sheets not exceeding $\frac{1}{8}$ in. thickness should usually dry in 9 to 10 days.

NOTE.—The best temperature for smoking is 120° to 130° F.

DEFECTS.

Crepe.

Defects to be Avoided.

Preventatives.

- | | |
|--|---|
| (1) Oil Streaks | ... See that oil from the bearings does not get on to the rubber— |
| | (a) through use of too much lubricating oil ; (b) through worn bearings. These should immediately be replaced, as oil from worn bearings contains particles of copper or verdigris, which gradually eat into the rubber and reduce it to the consistency of treacle. (c) by taking care that the crepe does not come near the edge of rolls or other parts of the machinery which may be oily. Trays under the washing mills should not project beyond the ends of the rolls. |
| (2) Dark streaks | ... Avoid oxidation and surface darkening of portions of the coagulated latex by the use of a little sodium bisulphite in the latex (for proportion, see paragraph 12 above). Do not allow the rollers to grind against each other. |
| (3) Mottling, Spots and Discoloration | Keep the crepe thin and do not hang it too closely in the store so that the rubber dries quickly. In case of persistent spot trouble, apply to the laboratory. |
| (4) Mouldiness | Proceed as in (3) and see that the rubber is thoroughly dry before packing. |

| Defects to be Avoided. | Preventatives. |
|---|--|
| (5) Cotton Fluff ... | Do not use cotton waste for keeping the oil off the rolls. If a pad is necessary, use one of cloth or flannel. Avoid using too much oil. |
| (6) Tackiness (Heat and stickiness) | See that rubber is not exposed to direct rays of the sun. Scrap should be brought in and washed as soon as possible—if there is unavoidable delay in washing, the scrap should be kept in water. |
| (7) Mouldiness ... | Efficient smoking (see also under (8)). |
| (8) Rust (Stretching rusty, resinous, or opaque) | The sheet should be scrubbed down with a stiff brush and plenty of water a few hours after rolling, allowed to drip for one hour, and then put into the smokehouse. If the latex is very rich, dilution with water before coagulation to a proportion of $1\frac{1}{2}$ to 2 lbs. of dry rubber to the gallon is recommended. |
| (9) Over Smoking ... (Dark-glossy surface) | This may be caused by the use of too large a proportion of coconut husks, rubber seed, or similar oily material. The timber used should not be wet and the fires must not be allowed to burst into flame. Do not use coconut oil for smoking. |
| (10) Tar deposits ... | See that the roof of the smokehouse does not drip owing to condensation. |
| (11) Thickened edges ... | Take care that the edges are not doubled over in rolling, as this gives sheets of an uneven thickness and liable to cut virgin. |

CARE OF MACHINERY.

Machines

must be well cleaned and inspected each day before commencing work. At frequent intervals (say, once a week), they should be well cleansed of all traces of oil by means of a 5 per cent. solution of caustic soda. This must be applied under European supervision, by means of a cloth fastened to the end of a stick. Afterwards the machines should be set in motion and the water allowed to run for some time, say ten minutes.

Lubrication.

The engine driver, or other responsible person, should do this work.

Worn Parts

must be replaced at once. Worn bearings are often the cause of "green streaks" in crepe rubber. When the grooves of rolls have become worn they cease to grip the rubber, thereby reducing the output of the machine and overworking the rubber.

SORTING AND GRADING.

Great attention and careful supervision are necessary for these operations. The fewer grades the better, and the regularity of each grade is most important.

The perfect assortment should consist of:—

| | |
|---------------------------------|---|
| No. 1.—Fine Sheet or Fine Crepe | Made from the free or liquid latex. |
| No. 2.—Clean light Brown Crepe | Made from lumps, which cannot go through the strainer, and skimmings. |
| No. 3.—Scrap Crepe | Made from tree scrap. |
| No. 4.—Dark Crepe | Made from bark shavings and the lower quality of scrap crepe. |

Earth rubber and any tacky rubber should be packed separately.

Colour.

Evenness is most desirable and any discoloured or mottled pieces must not be left in the first quality.

In No. 2 clean brown crepe, no grit or minute pieces of bark should be left in the rubber.

All pieces of scrap showing the slightest traces of heat must be picked out.

The Crepe usually known on the market as "specky brown" is often insufficiently washed; bark or other impurities left in the rubber reduces the value.

The lowest grade, naturally varies very much and special attention to washing is most advisable.

Smoked Sheets should only be of one quality. Any sheets over-smoked or showing imperfections should be packed separately.

Packing.

Opinions differ as to the suitability of cases employed, but there is no doubt that the wood must be planed, so that no splinters can get into the rubber.

As a general rule, the three-ply wood cases specially made for rubber are the most desirable. Care should be taken to see that the inside of the package is thoroughly clean before packing.

18 × 19 × 24 inches measurement and capable of holding up to about 200 lbs. is recommended for sheet.

21 × 21 × 24 inches measurement and capable of holding up to about 155 lbs. is recommended for crepe.

Other cases, which have proved satisfactory are the Japanese Momi and the Cochin case. Ordinary (local) native made chests are undesirable. Rubber should never be packed in bales.

N.B.—Consumers' worst enemy in rubber is heat and stickiness, a very little of which will often spoil an otherwise good parcel.

RUBBER FACTORIES.

Cost of Building.

A Rubber Curing Factory 50 ft. × 40 ft. wide with one upper floor and verandah on one side 21 ft. deep running the full length. Building constructed of steel framing and corrugated iron sheets. Teak windows and doors and cement floors throughout, erected ... Rs. 11,000

One all iron rubber factory 50 ft. × 36 ft. with ground floor and one upper floor of the same dimensions, an open verandah 15 ft. deep along one side, and an annexe to form an engine room, constructed of H. steel columns and cross beams, jarrah joists, teak tongued and grooved, upper floor, cement concrete ground floor, teak window and door frames and sashes, 24 W. G. galvanized corrugated sheets on roof sides and gables, dwarf brick or stone wall pointed with cement 3 ft. high, cement concrete foundations, galvanized iron 8 ins. half round eaves gutters and 4 ins. down pipes, ridge ventilator full length of roof, erected complete, exclusive of transport, about ... Rs. 10,750.

One Rubber Factory 50 ins. × 36 ins. with 15 ft. verandah having ground floor only, details as per above specification, erected complete, exclusive of transport, about ... Rs. 8,500

(WALKER, SONS & Co., LTD.)

PATENT "VENESTA" RUBBER PACKAGES.

| Size. | Weight. | Prices in Colombo, free on Rail. |
|--------------|-------------|----------------------------------|
| 21 x 21 x 24 | 16 lbs. | Rs. 2 40 |
| 12 x 19 x 24 | 14 " | " 2 30 |
| 24 x 24 x 12 | 13 ", 8 oz. | " 2 10 |

Venesta Cases of the same Internal Capacity as wooden cases measure from 10 % to 20 % less for Ocean Freight, and weight from 40 % to 60 % less, for Land Carriage, than wooden cases of the same internal over measurement.

| | | | | | |
|-----------------|-----|-----|-----|---------|----------|
| Rivets | ... | ... | ... | per lb. | Rs. 1 00 |
| Staples | ... | ... | ... | " | " 0 30 |
| Tags | ... | ... | ... | " | " 0 35 |
| Special Hammers | ... | ... | ... | each | " 1 25 |
| Rivet Holders | ... | ... | ... | " | " 0 08 |



ACCOUNT SALES OF 16 CASES PLANTATION RUBBER EX STEAMER AT COLOMBO.

PUBLIC SALE 24TH FEB., 1917.

PROMPT 14TH MARCH, 1917.

| | | | £. | s. | d. |
|--------|----------------------|------------|-----|------|----------|
| 7 Spl. | 10 Cases Crepe No. 2 | 1,297 lbs. | 2s. | 4½d. | 152 13 4 |
| 6½ " | 6 " Scrap Crepe | 823½ " | 2s. | 1½d. | 87 13 10 |
| | 16 | 2,130½ | | | |
| | Loss | 9½ | | | |
| | | 2,140 | | | £240 7 2 |

CHARGES.

| | | |
|---|-----|----------|
| Freight 98.8 c. ft. @ 60/- per ton of 50 c. ft. | ... | 5 18 5 |
| Interest on do | ... | 0 0 6 |
| Warehouse Charges | ... | 2 9 1 |
| Port Rate | ... | 0 3 7 |
| Sale Expenses | ... | 0 7 5 |
| Brokerage ½ % | ... | 1 4 0 |
| Marine Insurance | ... | 0 15 0 |
| Fire Insurance | ... | 0 2 6 |
| | | 11 0 7 |
| | | £229 6 7 |

J. & O. P.

London, 12th March, 1917.

NOTE :—The allowances of 2½% discount and ½% draft have been abolished.

ANOTHER EXAMPLE.

Account Sale of 29 packages of Rubber shipped per s.s. _____
from Colombo.

On Account of the Ichiban Rubber & Tea Estates Co., Ltd.

1917.

18th Nov. Sold at Public Sale.

Ichiban

| Lot 12. | | Cwt. | qrs. | lbs. | | | | | |
|------------|----------|------|------|--------|--------------|---------|--------|-----|-------|
| Nos. 1/13. | 13 Pkgs. | 13 | 2 | 16 G. | | | | | |
| | | 2 | 0 | 4 T. | | | | | |
| | | 11 | 2 | 12 | | | | | |
| | | | | 7 Spl. | Lbs. | Per lb. | | | |
| | | 11 | 2 | 19 | Nett = 1,307 | @ | 2/7½d. | £ | s. d. |
| | | | | | | | | 170 | 3 8 |
| Lot 13. | | | | | | | | | |
| Nos. 14/17 | 4 Pkgs. | 3 | 0 | 9 G. | | | | | |
| | | 0 | 2 | 1 T. | | | | | |
| | | 2 | 2 | 8 | | | | | |
| | | | | 6 Spl. | | | | | |
| | | 2 | 2 | 14 | Nett = 294 | @ | 2/2½d. | 32 | 9 3 |
| Lot 14. | | | | | | | | | |
| Nos. 18/25 | 8 Pkgs. | 8 | 1 | 11 G. | | | | | |
| | | 1 | 1 | 2 T. | | | | | |
| | | 7 | 0 | 9 | | | | | |
| | | | | 7 Spl. | | | | | |
| | | 7 | 0 | 16 | Nett = 300 | @ | 2/7½d. | 104 | 3 4 |
| Lot 15. | | | | | | | | | |
| Nos. 26/9. | 4 Pkgs. | 3 | 0 | 6 G. | | | | | |
| | | 0 | 2 | 0 T. | | | | | |
| | | 2 | 2 | 6 | | | | | |
| | | | | 6 Spl. | | | | | |
| | | 2 | 2 | 12 | Nett = 292 | @ | 2/2d. | 31 | 12 8 |
| 29 Pkgs. | | | | | 2,693 lbs. | | | 338 | 8 11 |

RUBBER

199

| | £ | s. | d. |
|--|------|----|------|
| Brought forward ... | 338 | 8 | 11 |
| Charges. | | | |
| Entry 3/6d; Freight on £6 2s. 8d. ... | 6 | 3 | 2 |
| Warehouse Charges, Rent and Stamps ... | 5 | 1 | 2 |
| Interest on Charges ... | 0 | 1 | 9 |
| Insurance on £350 @ 6s. 3d. % and Policy Stamp ... | 1 | 2 | 3 |
| Fire Insurance 11/9d.; P. Sale Charges 12/6d. ... | 1 | 4 | 3 |
| Brokerage $\frac{1}{4}$ % on £338 15s. 1d. ... | 1 | 13 | 8 |
| Commission $1\frac{1}{4}$ % on £338 15s. 1d. ... | 5 | 1 | 0 |
| | | 20 | 10 3 |
| Nett proceeds due 6th December, 1917. ... | £317 | 18 | 8 |

E. & O. E.

London, 10th December, 1917.

per pro JONES BROTHERS.

C.O.R.

* (A reduction of 30% of the Warehouse charges has now been made.)

Average Weight of Rubber per Package.

In 1911-12 the average nett weight per package imported into London was 124 lbs.

18 packages equal 1 ton.

CAPACITY OF A C. G. R. TRUCK.

| | Chests. | Half Chests. | Dimensions of Truck. |
|---------------|---------|--------------|---|
| 12 ton Wagons | 140 | 220 | 15' 0" x 8' 2 $\frac{1}{2}$ " x 7' 1 $\frac{1}{4}$ " = 830 Cubic ft. |
| 6 ton Wagons | 100 | 150 | 14' 10 $\frac{1}{4}$ " x 7' 2 $\frac{1}{4}$ " x 6' 6" = 685 Cubic ft. |

COLOMBO RUBBER SALES.

CONDITIONS.

1.—The Selling Broker shall open, inspect and sample the rubber. No rubber shall be catalogued until the seller has weighed the rubber at his stores (fractions of a pound in the nett weight of each lot to be disregarded) and the weights so obtained shall be those catalogued. All Catalogues shall be closed by 4 p.m. on the Monday previous to the sale. Catalogues shall be delivered to buyers, and samples to be on view at the Brokers' offices by 10 a.m. on the following Wednesday.

2.—The highest bidder shall be the purchaser, and any dispute that may arise to be settled by the Selling Broker, who is not to declare the name of the buyer until after the lot is knocked down, unless, in his

opinion, there shall be any uncertainty as to the actual bidder. The seller of the rubber, or any agent employed by him, or the Auctioneer shall have the right to bid.

3.—All rubber shall be sold by lot at so much per pound free of any duty levied under the Medical Wants Ordinance, 9 of 1912, which duty if any shall be payable by the seller. No less advance than 1 cent per lb. shall be made on any previous bid. When a bid is registered by the Selling Broker the bidder shall have the right to claim the rubber at any advance in price. Registered bids shall be confirmed by the Selling Broker not later than 4 p.m. on day of sale.

4.—A deposit of ten per cent. shall be made, if required, at the moment a lot is knocked down, failing which it will be immediately put up for re-sale.

5.—All rubber shall be ready for inspection immediately after the sale, and be paid for on catalogued weights on or before prompt date, which shall be five days from the date of sale (Sundays and Bank Holidays excepted).

On receipt of payment on or before noon on prompt day, the rubber shall vest in the buyer, and the seller shall forthwith issue delivery orders in favour of the buyer, who shall thereupon take delivery of such rubber at Sellers' stores.

The buyer shall have the right of weighing any rubber purchased at Sellers' stores, the seller providing the requisite scales and weights, and in the event of any discrepancy between catalogued and actual nett weight being discovered, the contract value of any such difference in weight shall be immediately adjusted (fractions of a pound to be disregarded).

6.—Should payment not be made by noon on prompt day the seller shall have the right on giving notice in writing to the buyer to re-sell the lot or lots at the risk of the buyer, who shall be liable for any loss resulting from such re-sale.

7.—The rubber shall be at seller's risk (to the amount of the contract value only) until and including prompt day, unless previously delivered, and after that at buyer's risk, except in the case of any dispute arising as to quality, colour, description, packing or weights, in which case it shall remain at seller's risk until such dispute is settled.

8.—All objections as to quality, colour, description, packing or weights shall be made on or before delivery, and no objection can be admitted subsequent to prompt day. Should packages be found to be in an unmerchable condition by the Selling Broker, the same shall be notified prior to sale.

9.—Brokers buying or selling rubber shall declare in writing their principals immediately after the sale, otherwise they themselves will be held responsible as principals.

10.—Should any dispute arise between buyer and seller in the matter of quality, colour, description, packing or weights, the same shall be referred to the arbitration of one arbitrator to be appointed by both parties or, if the parties cannot agree as to an arbitrator, to the arbitration of two arbitrators, one to be appointed by each party. The arbitrators shall before proceeding with the business of the arbitration appoint an umpire, to the arbitration of whom shall be referred all questions on which the arbitrators are unable to agree. The award of such arbitrator, arbitrators, or umpire (as the case may be) shall be final, conclusive and binding on all parties. If either party shall refuse or neglect to appoint an arbitrator within three days after the other party shall have appointed an arbitrator on his part, and shall have served or posted under registered cover written notice requiring him to make such appointment, then the arbitrator appointed as aforesaid shall, at the request of the party appointing him, proceed to arbitrate on the matter in dispute as if he were an arbitrator appointed by both parties for that purpose.

11.—No rubber shall be put up for sale at the Ceylon Chamber of Commerce Sale Rooms except by Members of the Ceylon Chamber of Commerce or of the Colombo Brokers' Association as principals with the exception of rubber that is guaranteed by the Selling Broker as being on Garden Account.

12.—Additions or alterations to the above Rules may be made from time to time as occasion arises, at a General Meeting of The Ceylon Chamber of Commerce to be called for such purpose in accordance with the rules of the Chamber.

PLANTATION RUBBER.

RULES.

1.—All sales by private treaty purporting to be made subject to the Rules of the Rubber Trade Association of London, hereafter referred to as "the Association," shall be considered as made subject to the following Rules.

2.—All Rubber sold at public auction shall be considered as sold subject to these Rules. The highest bidder at a public auction whose bid is accepted shall be the buyer, but the Vendor shall have the right to bid by himself or his Agent or to alter or withdraw any lot or lots ;

if any dispute shall arise the Auctioneer shall declare whose bid he took, in which case his decision shall be final, or it may be left to a show of hands in the room to decide whether the lot is to be put up again. An entry made in the catalogue by the Auctioneer of a sale shall bind both seller and buyer, and the Auctioneer shall be deemed their Agent for this purpose. All catalogues must be ready and Samples on show not later than 11 a.m. on the Saturday preceding the auction.

3.—If a purchaser at a public sale be not satisfactorily known to the Auctioneer, the Auctioneer may immediately call on him for payment of a deposit of 20 per cent., or for such deposit as is expressed in the Catalogue, and in default of payment the Auctioneer shall be entitled to cancel the contract immediately or to re-sell the Rubber at his discretion, the loss, if any, to be made good by the defaulter. The biddings of parties who have been defaulters at previous Sales, or who may not be satisfactorily known to the Auctioneer, may be rejected at his discretion. In case of non-delivery owing to damage or destruction arising from fire the deposit shall be returned, and Contract for such portion be cancelled.

Prompt.

4.—Prompt, Saturday fortnight from date of sale or tender, sales or tenders dated on Saturday to be prompt that day fortnight. On Contracts made on and after 1st January, 1914, no allowance for Draft or Discount shall be made. Interest at 5 per cent. per annum on all prepayments against Delivery Order.

The cash hours shall be 3-30 p.m. for Brokers, and 3-40 p.m. for Merchants (Saturdays 12-30 p.m. and 12-40 p.m. respectively) up to which times cheques must be received, and payments received after such times shall date from the following working day. For the purpose of this Rule, Brokers act for their principals.

For any tender received after 1 p.m. on Saturdays the prompt to be exact 14 days from the following Monday, and during further circulation of the tender prompt to be exact 14 days from the date such subsequent tender is received.

Tenders.

5.—For a tender to be good the first seller must be in a position to deliver on the day of tender.

Tenders to be made on official forms which may be obtained from the Association, and the original tenders are to be circulated, each party endorsing time of receipt on the form.

From.....Reference No.....
Date.....Original Prompt.....

| Marka. | Nos. | Cases. | Description. | Ships. | Wharf. | Weight in lbs. | Sample lbs. (additional). | No. & Date of Certificate. | First Selling Brokers. |
|--------|------|--------|--------------|--------|--------|-------------------|------------------------------|----------------------------------|---------------------------|
| | | | | | | { | | | |

| | | |
|------------------------|------------------------|------------------------|
| No. 2. To..... | No. 4. To..... | No. 6. To..... |
| Date..... Time in..... | Date..... Time in..... | Date..... Time in..... |
| Signature..... | Signature..... | Signature..... |
| <hr/> | | |
| No. 3. To..... | No. 5. To..... | No. 7. To..... |
| Date..... Time in..... | Date..... Time in..... | Date..... Time in..... |
| Signature..... | Signature..... | Signature..... |

Tender form shall be accompanied by Memorandum in following form.

PLANTATION RUBBER.

From..... To.....
Date.....

Dear Sirs,

Against our Contract dated.....

for.....^{lbs.}.....^{tons}..... Plantation Rubber for.....

delivery at..... per lb.* we beg to hand you herewith Tender

No..... for.....^{lbs.}.....

Prompt.....

Yours truly,

No addition can be made to a tender and when an original tender is split, fresh tenders must be made out, giving original particulars and circulated as continuations of the original. The original tender form must be endorsed with particulars of the splitting by the party doing so and lodged forthwith with the Secretary of the Association.

When a tender is split and individual parcels divided, any necessary samples to represent each portion must be drawn at the expense of the party splitting the tender.

Each tender must contain the name and reference number of the first tenderer and name of first Selling Broker at whose office the samples must be lying.

6.—Buyers shall have the option of rejecting any tender of less than 2,000 lbs., except in completion of a contract, but individual tenders of less than 2,000 lbs. may be combined together for the purpose of providing a tender of the minimum quantity allowed.

7.—Rubber to be tenderable must be in its original cases (breakage excepted) bearing its original shipping marks, as shipped from the place of production.

Standard Qualities.

8.—All Rubber sold under Standard descriptions before being tendered must be certified by the Standard Qualities Committee and the Certificate shall remain in force for three months, provided the cases have been left intact at the original public warehouse.

Samples to be submitted to the Standard Qualities Committee must be freshly drawn dock or wharf samples and delivered intact to such Committee but in the case of any lot which has been included in the last public sale preceding the date of submission the dock or wharf sample shown at that time shall be sufficient if reasonably intact, and accompanied by a reference to the respective catalogue and lot number. Samples must be sent to the Standard Qualities Committee not later than twelve o'clock on the eighth working day before the end of the period of delivery, with liberty to the seller to make one replacement of any quantity rejected by the Committee within two working days of receiving notice of rejection (provided that in the opinion of the Standard Qualities Committee the sample submitted to them was a *bona fide* submission for tendering) and notwithstanding that by reason of such rejection and replacement the seller would, but for the provision, be out of time to make his tender.

Samples.

9.—Samples shall be taken by last buyer as part of the contract quantity and be paid for at contract price.

No charge to sellers for returning samples.

Application for Delivery on String Tenders.

10.—Should the last buyer on a string tender require immediate delivery, he shall apply to first selling broker. Delivery order when received shall be handed with last buyer's application to the first buyer, who must pass on same with due despatch, cash against delivery order. Sellers shall not be entitled to tender a delivery order to next buyer and claim payment under this Clause after 3 p.m. from Brokers, or after 3-15 p.m. from Merchants.

10A.—Unless otherwise specified in the Contract the sale of a parcel as Spot implies that Buyers are entitled to Delivery Order not later than 3 p.m. on the day following the application for delivery and in default to cancel the Contract. Any damages incurred in consequence of the default to be assessed by Arbitration.

Payments on Account for other than String Tenders.

11.—Buyers who have applied for a delivery order or orders before 2 p.m. (Saturdays 11-30 a.m.) shall be entitled to make payment on account at any time up to 3-30 p.m. (Saturdays 12-30 p.m.), whether selling brokers are in a position to give delivery order or not, and buyers shall be entitled to interest at 5 per cent. per annum from date of payment to prompt on pre-payments so made. Brokers who have applied to Merchants for delivery before 2-30 p.m. (Saturdays 12 p.m.) shall similarly be entitled to make payment on account to Merchants up to 3-40 p.m. (Saturdays 12-40 p.m.), and to receive interest on such payments.

This Rule shall not apply to string tenders on which payments on account need not be accepted unless sellers—whether Merchants or Brokers—are in possession of delivery order.

Reweights.

12.—Rubber to be taken at reweights. Weighing at the option of the seller at any time between the Wednesday week preceding prompt and the Thursday before prompt day, both days inclusive.

Weights shall be held at the disposal of the last buyer by the first seller.

Delivery Weight.

13.—Final delivery on any delivery or shipment Contract to be within 100 lbs. of the weight contracted for, but in any case the nearest weight to the Contract quantity that the average weight of the cases of the final tender admits. Net weight to be taken after deduction of tare and without any consideration of draft allowance.

But where it is found impossible to deliver within 100 lbs. taking the average weight of the cases tendered any such deficiency or excess shall be invoiced back, or invoiced as the case may be, at the price fixed by the Committee of the Association at the end of the month or months of delivery.

Any shortage of excess delivery up to 240 lbs. in weight shall be invoiced back, or invoiced as the case may be, at the price fixed by the Committee of the Association at the end of the month or months contracted for.

Claims for such differences must be rendered within eight working days after the last day of the period of delivery, or of final prompt (whichever is later).

Default and Excess accounts are due in cash on or before the 14th day of the month following default or excess.

No accounts to be rendered for amounts less than £1 10s.

Tender for final delivery on any Contract shall be nearest weight to the Contract quantity that the average weight of the cases of such tender admits, but a buyer who has received delivery or tender to within 100 lbs. of the Contract quantity may decline to accept further tender.

When the final delivery weight is not more than 100 lbs. under or over the Contract quantity, such weight shall be accepted in fulfilment of the Contract.

When the shortage or excess is more than 100 lbs. but does not exceed 240 lbs. the whole of such shortage or excess shall be invoiced back or invoiced as the case may be at the price fixed by the Committee of the Association at the end of the month or months of delivery. Any such shortage or excess beyond 240 lbs. shall be invoiced back or invoiced as the case may be at a price to be fixed by arbitration in accordance with Rule 14.

Accounts for shortage or excess to be rendered by Buying and Selling Brokers within seven days of receipt of final weights, or period of delivery, whichever is later. No such accounts to be rendered for amounts less than £1 10s.

Default.

14.—Whenever it may be admitted by the seller, or decided by arbitration that the seller has failed to fulfil the terms of the Contract, the buyer shall "close" by invoicing back the Rubber to the seller at once, at a price and weight to be fixed by arbitration, which price shall not be less than 2 per cent., and not more than 10 per cent. over the estimated market value of the shipment contracted for on the day upon which the default occurs, the difference to be due in cash in seven days.

Whenever it may be declared by the first seller, or decided by arbitration that he has failed to fulfil the terms of his Contract, the rubber shall be invoiced back to him at a price and weight to be fixed by arbitration, which price shall be the estimated market value of the rubber contracted for on the day upon which default occurs or the day following, plus a penalty of not less than 1d. per lb.^s and not more than 6d. per lb.

But when a party to a string Contract, other than the first seller, shall fail to make his tender in fulfilment of his Contract by reason of not receiving such tender from his seller within the time specified in Rules 15 and 15a, the Rubber shall be invoiced back at a price and weight to be fixed by arbitration, which price shall be the estimated market value of the Rubber on the day on which default occurs, or the day following plus a penalty of not more than 1d. per lb. :

All differences shall be due in cash in seven days from the date of default. All notices of default shall be given and passed on as provided in Rule 15 for tenders.

Delivery Contracts.

15.—On Contracts for Rubber sold under the standard descriptions for future delivery, the Rubber when tendered must be ready for delivery in sound order and condition at one of the customary docks or wharves. The tender to be received by the first buyer before 3-30 o'clock (11-30 o'clock on Saturdays) not later than the fifth working day before the end of the period of delivery (excepting only in the case mentioned in Rule 3) and the first and each subsequent buyer must pass same on with due despatch, but in any case within one hour of receipt; tenders received between 1 and 2 p.m. must be received by the next buyer before 3 p.m., but in no case later than 5 o'clock on the last working day of the period of delivery (1 p.m. on Saturdays). For the purpose of this Rule a day is to be taken as commencing at 10 a.m. and ending at 5 p.m. (Saturdays 1 p.m.); also the buyer shall be represented by the selling Broker and all tenders so received by the selling Broker are to be considered as received by him on account of his buyer. Any party failing to re-tender within the times specified as above becomes a first seller.

On Contracts for Rubber sold under the standard descriptions for future delivery, the Rubber when tendered must be ready for delivery in sound order and condition^s at one of the customary docks or wharves. The tender must be made to the first buyer not later than 3-30 o'clock (11-30 o'clock on Saturdays) on the sixth working day before the end of the period of delivery (excepting only in the case mentioned in Rule 8) and the first and each subsequent buyer must pass same on with due despatch, but in any case within one hour of receipt and in no case later than 5 o'clock on the third working day before the end of the period of

delivery (1 p.m. on Saturdays). Tenders received between 1 and 2 p.m. must be received by the next buyer before 3 p.m. For the purpose of this rule a working day is to be taken as commencing at 10 a.m. and ending at 5 p.m. (Saturdays 1 p.m.) also the buyer shall be represented by the selling Broker and all tenders so received by the selling Broker are to be considered as received by him on account of his buyer. Any party failing to re-tender within the times specified as above becomes a first seller.

On Contracts for Rubber sold under other than the standard descriptions for future delivery, the first seller shall make his tender not later than 3-30 p.m. of the fourth working day (Saturdays 11-30) before the end of the period of delivery and subsequent tenders shall be passed on as provided for in Rule 15.

Shipment Contracts.

16.—When a parcel of Rubber is sold under one of the Standard descriptions for a specified shipment, or for shipment by a specified steamer and found inferior, or if any portion tendered be found inferior, buyers shall have the option of rejection, and the quantity so rejected whether the whole or any portion, shall not constitute a delivery on the Contract, but should the time for delivery have expired the seller shall be allowed three clear working days to replace the quantity rejected (provided that such quantity was in the opinion of the Arbitrators a *bona fide* tender) otherwise Clause 14 of these Rules to apply.

If Rubber is Inferior to Guarantee by over 2d. per lb.

17.—When a parcel of Rubber is sold with a guarantee of quality other than as specified in Rule 15 for a specified shipment or delivery, or for shipment by a specified steamer and found inferior, or if any portion tendered be found inferior, the buyer must accept the same with an allowance provided such allowance in the opinion of the Arbitrators be not more than 2d. (two pence) per lb. or otherwise as may be specified in the contract, but should the parcel or any portion tendered be rejected, the seller to have the option (provided that it was in the opinion of the Arbitrators a *bona fide* tender) of substituting guaranteed quality on the spot, to fulfil his contract within three clear working days, or the expiration of time for delivery as the case may be, otherwise Clause 14 of these Rules to apply.

Delivery and Shipment Contracts.

18.—When sold for monthly deliveries or shipment each month or specified part of a month's delivery or shipment to be treated as a separate Contract.

Time allowed for Claims or Objections.

19.—Any claim (a copy of which must be circulated amongst the parties interested) must be made by the last buyer to the first selling Broker in writing within three clear working days of the last buyer receiving tender, and the first seller shall consider this as being in time.

Solvency Guarantee.

20.—The selling or buying broker guarantees the solvency of his principals during the continuance of contracts in all contracts for Rubber unless otherwise specified in the Contract.

Fire Insurance.

21.—Rubber sold or tendered, to be at the risk of sellers (to the amount of the Contract value only) until the prompt day or day of actual delivery from dock or wharf before that day and in the event of damage or destruction by fire all payments on account and differences to be returned, and Contract for such portion to be cancelled.

Power to "Set off."

22.—In the event of there being more than one Contract subsisting between the same parties which shall be closed in pursuance of Clause 22 of the General Regulations relating to the constitution of the Association, an account shall be taken of what is due from the one party to the other in respect of such Contracts and the sum due from the one party shall be set off against the sum due from the other party, and the balance of the accounts and no more shall be claimed or paid on either side respectively.

General.

23.—When the subject matter and terms of contract are identical, or identical except as to date and price, all arbitrations shall be held as between first seller and last buyer as though they were contracting parties, and the award made in pursuance thereof, subject to the right of appeal to the Committee of the Association, shall be binding on all intermediate parties, providing the terms of the contracts have been duly fulfilled.

24.—Should the seller be prevented from delivering, or the buyer from taking delivery during the period stipulated in the contract by the reason of war, riots, strikes or combinations of workmen or lockouts, the time allowed for delivery shall be extended until the operation of the causes preventing delivery has ceased.

25.—Any notice required to be given by these Rules may be delivered personally or left at or posted to the last known place of business of the party to whom it is addressed.

26.—Where an act has to be done on or before a given day and such day shall happen to be a non-business day, such act must be done on or before the next following business day, unless provision is made in the Rules to the contrary. Bank Holidays, Christmas day, Good Friday and Sundays shall not be considered working days.

27.—In these Rules unless the context otherwise requires words importing the singular number only shall include the plural number, and words importing the plural number only shall include the singular number, and words importing persons shall include firms and corporations.

28.—The words "about" or "more or less," when used to define quantities contracted for, shall mean the nearest amount which sellers can fairly and reasonably deliver but no excess or deficiency shall be greater than $2\frac{1}{2}$ per cent. The word "Ton" shall mean a ton of 2,240 lb.

29.—Any slight variation in marks (other than quality marks) numbers or ship's name shall not vitiate a contract.

30.—These Rules shall govern all contracts made on or after 1st May, 1913.

The following Extracts from bulletins of the Department of Agriculture are of interest. Acknowledgment is made of the courtesy of the Director of Agriculture in permitting the use of these bulletins.

VULCANIZATION TESTS.

Summary Report from Professor Wyndham R. Dunstan on Samples
prepared by Mr. L. E. Campbell, Ceylon Rubber Research
Chemist, May, 1915.

Investigations have been conducted in Ceylon and at the Imperial Institute to determine the effect of various factors on the vulcanizing and mechanical properties of rubber. The two detailed reports already made by the Imperial Institute to the Rubber Research Committee in Ceylon have dealt with the following points:—

- (1) The effect of different methods of coagulation.
- (2) The effect of adding ammonia, sodium sulphite, or formaldehyde to latex before coagulation.
- (3) The effect of the form of the rubber (sheet, crêpe, &c.).

Specimens intended for direct comparison were in every case prepared from one and the same sample of bulked latex.

The general conclusion indicated by the results obtained up to the present is that the principal variation shown by plantation Para rubber is not so much in tensile strength or elongation as in the time of vulcanization necessary to obtain the best mechanical results. The proper time of vulcanization has therefore to be determined experimentally for each specimen before satisfactory mechanical tests can be made.

The following account summarizes the results obtained with reference to (1) tensile strength, (2) elongation, and (3) time of vulcanization.

Tensile Strength.

Excluding one set of eight specimens which for some reason gave abnormal results, the following table summarizes the figures obtained for the whole of the specimens of sheet and crêpe rubbers examined, 64 in all:—

| Tensile Strength, lb. per Square Inch. | No. of Specimens. |
|---|----------------------|
| Below 2,000 | 3 |
| From 2,000 to 2,099 | 6 |
| From 2,100 to 2,199 | 7 |
| From 2,200 to 2,299 | 14 |
| From 2,300 to 2,399 | 22 |
| From 2,400 to 2,499 | 8 |
| 2,500 and over | 4 |
| | <hr/> 64 |

The maximum tensile strength of these 64 specimens was 2,571 lb., and the minimum 1,607 lb.

Two samples of best fine hard Para tested in exactly similar manner for comparison gave values of 2,276 lb. and 2,312 lb.

With reference to the different groups of experiments it may be noted that—

- (a) Rubber prepared by spontaneous coagulation of the latex gave very good tensile values, equal to those of rubber coagulated by the addition of acids.
- (b) Scrap rubber from the trees possessed low tensile strength in every case.
- (c) The use of different acids (acetic, formic, and sulphuric) for coagulation had little effect on the tensile strength of rubber produced; two of the specimens prepared with hydrofluoric acid gave distinctly lower values than the corresponding specimens prepared with acetic acid, whilst

three others gave only slightly lower figures. The amounts of acid used in these experiments were 0.13 gram of acetic acid, 0.07 gram of formic acid, 0.10 gram of sulphuric acid, and 0.04 gram of hydrofluoric acid per 100 cc. of undiluted latex.

- (d) The use of double the above amounts of the different acids had no marked effect on the tensile strength of the rubber.
- (e) The addition of ammonia (0.0056 per cent.), sodium sulphite (0.2 per cent.), or formaldehyde (0.5 per cent.) to the latex before coagulation had no marked effect on the tensile strength of the rubber.
- (f) No decided or constant difference was observed between the results of the tensile tests in the case of hand-made and machine-made sheet; in four out of six comparative pairs of specimens the machine-made sheet showed a slight advantage.
- (g) The thick crêpe gave in every case slightly better figures than the corresponding thin crêpe (both thin and thick crêpe being made by passing the coagulum through the rollers an equal number of times).
- (h) In six comparative groups of specimens the average strength of the two samples of sheet rubber (hand-made and machine-made) was invariably higher than that of the two corresponding samples of crepe (thick and thin), but the differences were usually not very large; the tensile strength of the thick crêpe approximated to that of the sheet.

Elongation.

The elongations at the breaking point of the 64 specimens ranged from 787 to 919 per cent., i.e., the test-pieces stretched from 7.87 to 9.19 times their original length before breaking. The results are summarized in the following table:—

| Elongation, per Cent. | No. of Specimens. |
|-----------------------|-------------------|
| Below 800 | 1 |
| From 800 to 824 | 1 |
| From 825 to 849 | 7 |
| From 850 to 874 | 24 |
| From 875 to 899 | 29 |
| 900 and over | 2 |
| | <hr/> 64 |

Note.—A few of the samples which gave results below 800 per cent. were a little over-cured.

The effect of the various factors on the elongation of the rubber was not very marked or constant.

Two samples of best fine hard Para tested in exactly similar manner for comparison gave elongations of 893 and 880 per cent.

Time of Vulcanization.

The times of cure of the 64 specimens of sheet and crêpe showed very considerable variation, ranging from 50 to 120 minutes. A standard mixing of 90 parts of rubber and 10 parts of sulphur was employed throughout the experiments, and vulcanization was effected at a constant steam pressure of 50 lb. per square inch.

The results obtained as to time of cure may be summarized as follows:—

- (a) Hand-made sheet cured in every case quicker than machine-made sheet.
- (b) In five out of six pairs of comparative specimens thin crêpe required a longer time of vulcanization than thick crêpe (both thin and thick crêpe being made by passing the coagulum through the rollers an equal number of times).
- (c) In seven out of eight pairs of comparative samples thin crêpe required a distinctly longer time of cure than the corresponding sheet.

The results in these three sections (a), (b), and (c) suggest that increased mechanical treatment of the coagulum lengthens the time of cure.

- (d) Rubber prepared from the same sample of bulked latex by coagulation with different acids (using the minimum amounts of acid previously given) had approximately the same time of cure; when double the minimum amounts of acid were used the time of cure was not much affected in the case of acetic acid, but was distinctly increased in the cases of sulphuric and hydrofluoric acids; the results with formic acid were contradictory.
- (e) The addition of ammonia and sodium sulphite to latex before coagulation had no constant effect on the time of cure, but an excess of formaldehyde lengthened the time very considerably.
- (f) The time of cure of the "control" samples, which were prepared under exactly identical conditions, but from different batches of latex and different sets of trees, varied from 60 to 80 minutes, but was generally about 70 to 75 minutes; some variation in time of cure therefore appears to be inevitable.

*Influence of Washing on the Vulcanizing and
Mechanical Properties.*

The following results obtained at the Imperial Institute in the course of experimental work connected with this investigation of Ceylon rubbers will be of interest. They show the effect of vulcanizing sheet rubber (1) without washing and (2) after washing :—

| | | Time of | | Tensile Strength, | | Elongation, per Cent. |
|----------------------|--------------|----------------|--------------|-------------------|------|--------------------------|
| | | Vulcanization, | lb. per | | | |
| <i>Smoked Sheet.</i> | | Minutes. | Square Inch. | | | |
| 1. | { Not washed | .. | 98 | ... | 2151 | 899 |
| | { Washed | ... | 100 | ... | 2295 | 888 |
| 2. | { Not washed | ... | 98 | ... | 2304 | 867 |
| | { Washed | ... | 100 | ... | 2372 | 861 |
| 3. | { Not washed | ... | 100 | ... | 2317 | 904 |
| | { Washed | ... | 100 | ... | 2258 | 882 |
| 4. | { Not washed | ... | 100 | ... | 2292 | 859 |
| | { Washed | ... | 100 | ... | 2353 | 850 |
| 5. | { Not washed | ... | 100 | ... | 2429 | 852 |
| | { Washed | ... | 100 | ... | 2455 | 870 |
| <i>Plain Sheet.</i> | | | | | | |
| Not washed | | ... | 80 | ... | 2545 | 854 |
| Washed | | ... | 85* | ... | 2604 | 830 |

It will be seen that the differences in the tensile strengths of the washed and unwashed rubber are comparatively small in each case, only exceeding 70 lb. per square inch in one out of the six samples. In five of the sample the higher tensile strength was obtained from the rubber after washing. The washing had practically no effect on the time of cure in these cases.

**A Summary of the Vulcanization Tests at the Imperial Institute on
Samples of Rubber prepared at Gikiyanakanda.**

The following summary of some features of the reports is only an account of the general nature of the results so far obtained.

All specimens for direct comparative tests were made from bulked latex collected in one day from reserved trees tapped every third day according to the general practice on that division of the estate.

The rubber, except where otherwise stated, was made into sheet, rolled five times, space between the rollers being diminished each time; it was washed between each rolling, and finally dried in ordinary air temperature (85°-90° F.), drying occupying three to five weeks.

* Slightly over-cured.

Crêpe rubber was made on straight groove rollers that revolved in the ratio of 2 to 1. The crêpe finally passed between smooth rollers revolving at equal speed.

The control specimens were prepared from bulked latex in each section, and prepared in the same way throughout, so that they are comparable one with another. They were coagulated with acetic acid in the proportion of 0.2 gram acetic acid to 100 cc. of normal latex.

This quantity of acid was used whenever samples were prepared by acetic acid, unless the contrary is stated.

The rubber was vulcanized with sulphur only, the mixture containing 90 per cent. rubber and 10 per cent. sulphur, vulcanized in moulds heated by steam at 50 lb. pressure to 147° C. The vulcanized sheets were kept for at least three days. Circular rings were then cut from them for testing.

Tensile strength refers to the load, calculated in pounds per square inch, which the rings carried at the breaking point.

Elongation is the percentage of its original length a ring has stretched at the breaking point; *e.g.*, if elongation is 800 it means that the ring has stretched eight times its original length.

The ratio columns have been introduced for the purpose of comparisons being easily made; one sample, generally the control, being selected for the unit quantity of 100.

COMPARISON OF COAGULANTS.

In each case the minimum and twice the minimum amount of acid was used. With acetic acid this was 0.13 and 0.26 grams, respectively, acetic acid per 100 cc. latex (33 per cent. dry rubber).

Coagulation was very slow when minimum amounts of acid were used, the complete process lasting 16 hours, as compared with half an hour when twice the minimum quantities were applied.

The mechanical tests gave somewhat better results with acetic and formic when the larger quantities were used; with purub (hydrofluoric acid) and sulphuric they favoured the small.

In the following table the results refer to samples with which the minimum of acid was used in the case of purub and twice the minimum in the case of the other acids:—

I.—*Latex from 7-year-old Trees.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elongation. | Ratio. |
|-----------------------------|-------|--------|----------------------|--------|-------------|--------|
| Control | ... | 75 | 100 | 2018 | 873 | 100.0 |
| Acetic acid (twice minimum) | 75 | 100 | 2127 | 105.4 | 894 | 102.4 |
| Formic acid (twice minimum) | 75 | 100 | 2080 | 103.0 | 865 | 99.1 |
| Purub (minimum) | ... | 75 | 1781 | 88.2 | 864 | 101.3 |
| Sulphuric acid (minimum) | ... | 75 | 2219 | 109.9 | 864 | 98.9 |

There was no difference in time of vulcanization; the sulphuric acid sample gave the best results in tensile strength, the acetic acid in elongation.

Latex from Trees 16 to 20 Years Old.

Specimens were prepared in the same way. Comparing the result of solutions of minimum and twice the minimum strengths we find the curves conflicting. In every case the time of vulcanization and the elongation favoured the minimum. For tensile strength acetic, hydrofluoric, and sulphuric gave slightly better results with the stronger solutions; formic acid with the weaker.

II.—*Latex from Trees 16 to 20 Years Old.*

| | Time. | Ratio. | Elongation. | Ratio. |
|-----------------------------|-------|--------|-------------|--------|
| Control | ... | 75 | 100 | 100 |
| Acetic acid (minimum) | ... | 75 | 100 | 100.2 |
| Formic acid (minimum) | ... | 75 | 100 | 89.6 |
| Hydrofluoric acid (minimum) | ... | 80 | 93.7 | 89.3 |
| Sulphuric acid (minimum) | ... | 80 | 93.7 | 99.7 |

The most conspicuous feature in this comparison is the extra time required for vulcanizing the purub and sulphuric samples.

III.—*Latex from Trees 16 to 20 Years Old.*

| | Tensile Strength. | Ratio. |
|-----------------------------------|-------------------|--------|
| Control | 2293 | 100 |
| Acetic acid (twice minimum) | 1832 | 79.9 |
| Formic acid (minimum) | 1701 | 74.2 |
| Hydrofluoric acid (twice minimum) | 1606 | 70 |
| Sulphuric acid (twice minimum) | 1752 | 76.4 |

Acetic acid is well ahead in this comparison, but yet, with double the minimum, vulcanization took 80 minutes, and the elongation was 860 (98.2 per cent. of control) lower than any other.

HOT AND COLD COAGULATION.

The next section deals with hot coagulation, i.e., latex heated to 60° C., acetic acid added, and the mixture then raised to 80° C.; compared with cold coagulation, i.e., latex coagulated at ordinary temperature, the same amount of acid being used. In one experiment the rubber was made into sheet, in the other it was creped.

IV.—*Latex from 7-year-old Trees.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elon- gation. | Ratio. |
|------------------|---------|--------|----------------------|--------|------------------|--------|
| <i>Sheet.</i> | | | | | | |
| Control | ... 65 | 100 | ... 2369 | 100 | ... 853 | 100 |
| Hot coagulation | ... 95 | 68.4 | ... 2314 | 97.6 | ... 842 | 98.7 |
| Cold coagulation | ... 65 | 100 | ... 2145 | 90.5 | ... 882 | 103.4 |
| <i>Crépe.</i> | | | | | | |
| Control | ... 60 | 100 | ... 2306 | 100 | ... 848 | 100 |
| Hot coagulation | ... 105 | 57.1 | ... 2122 | 92.02 | ... 877 | 103.4 |
| Cold coagulation | ... 100 | 60 | ... 2057 | 89.2 | ... 853 | 100.6 |

Cold coagulation gave better results in the case of sheet, except in tensile strength, and in that of crépe except in elongation.

V.—*Latex from Trees 16 to 20 Years Old.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elon- gation. | Ratio. |
|------------------|---------|--------|----------------------|--------|------------------|--------|
| <i>Sheet.</i> | | | | | | |
| Control | ... 70 | 100 | ... 2341 | 100 | ... 864 | 100 |
| Hot coagulation | ... 77 | 90.9 | ... 2239 | 95.6 | ... 849 | 98.2 |
| Cold coagulation | ... 65 | 107.7 | ... 2281 | 97.5 | ... 884 | 102.3 |
| <i>Crépe.</i> | | | | | | |
| Hot coagulation | ... 105 | 66.7 | ... 2291 | 97.8 | ... 845 | 97.3 |
| Cold coagulation | ... 105 | 66.7 | ... 2511 | 107.3 | ... 872 | 100.9 |

In the case of both sheet and crépe cold coagulation gave better results than hot.

YOUNG AND OLDER TREES.

In the following table (VI.) the records of the rubber from 7-year-old trees are compared with those of rubber from 16 to 20-year-old trees.

VI.—*Latex from 7 and 16 to 20-year-old Trees.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elon- gation. | Ratio. |
|-------------------|--------|--------|----------------------|--------|------------------|--------|
| 7-year-old | ... 81 | 100 | ... 2174 | 100 | ... 865 | 100 |
| 16 to 20-year-old | ... 88 | 94.2 | ... 2142 | 98.6 | ... 908 | 104.9 |

The differences between the tensile strengths and between the elongation are within the limits of experimental error.

FORM OF RUBBER.

Four forms of rubber were prepared :—

- (1) Hand pressed on the system formerly followed on small native estates, namely, pressing with hand, then stretching and pressing with a bottle or rolling pin.
- (2) Machine sheet.

(3) Thin crêpe; rubber passed four times between rollers at constant distant apart, and then once through smooth rollers. Time of drying one week.

(4) Thick crêpe; rubber rolled through rough rollers four times to required thickness, and then once through smooth rollers wide apart. Drying took place very slowly.

We select for comparison samples coagulated by acetic acid :—

VII.—*Latex from 7-year-old Trees.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elongation. | Ratio. |
|----------------|---------|--------|----------------------|--------|-------------|--------|
| Control | .. 80 | 100 | .. 2478 | 100 | .. 862 | 100 |
| Pressed sheet | ... 50 | 180 | .. 2367 | 95.5 | .. 888 | 103 |
| Machined sheet | ... 75 | 106.6 | 2400 | 96.9 | .. 877 | 101.7 |
| Thin crêpe | ... 105 | 76.1 | .. 2209 | 89.1 | .. 899 | 104.3 |
| Thick crêpe | ... 102 | 78.4 | .. 2280 | 92 | .. 883 | 102.4 |

VII. A.—*Tests Repeated.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elongation. | Ratio. |
|----------------|---------|--------|----------------------|--------|-------------|--------|
| Control | ... 75 | 100 | .. 2571 | 100 | .. 863 | 100 |
| Pressed sheet | ... 65 | 115.4 | .. 2534 | 98.5 | .. 859 | 99.5 |
| Machined sheet | .. 85 | 88.2 | .. 2387 | 92.8 | .. 871 | 100.4 |
| Thin crêpe | ... 110 | 68.2 | .. 2303 | 89.5 | .. 846 | 98 |
| Thick crêpe | ... 90 | 83.3 | .. 2351 | 91.7 | .. 884 | 102.4 |

VIII.—*Latex from 16 to 20-year-old Trees.*

| | Time. | Ratio. | Tensile Strength. | Ratio. | Elongation. | Ratio. |
|----------------|---------|--------|----------------------|--------|-------------|--------|
| Control | ... 75 | 100 | .. 2492 | 100 | .. 890 | 100 |
| Pressed sheet | .. 72 | 104.1 | .. 2483 | 99.6 | .. 869 | 97.6 |
| Machined sheet | ... 85 | 88.2 | .. 2514 | 100.9 | .. 842 | 94.6 |
| Thin crêpe | ... 100 | 75 | .. 2285 | 91.6 | .. 900 | 101.1 |
| Thick crêpe | ... 90 | 83.3 | .. 2309 | 92.2 | .. 876 | 98.4 |

In the three foregoing tables sheet is well ahead of crêpe in time and tensile strength; crêpe shows slightly better results in elongation. Thick crêpe showed a superiority over thin crêpe in tensile strength.

The following tables give the mean values of all the sheet and crêpe specimens tabulated in the report, whether coagulated by acetic acid or hydrofluoric acid, pressed and machine sheet and thick and thin crêpe being averaged :—

IX.

| | | | Tensile Strength. | Ratio. |
|-------|-----|-----|----------------------|--------|
| Sheet | ... | ... | 2386 | 100 |
| Crepe | ... | ... | 2286 | 95 |

X.

| | | | Elongation. | Ratio. |
|-------|-----|-----|-------------|--------|
| Sheet | ... | ... | 872 | 100 |
| Crepe | ... | ... | 883 | 101 |

Crêping seems to reduce slightly the tensile strength. The specimen which gave the highest tensile strength (2571) was a piece of control sheet from 7-year-old trees; the next, pressed sheet (2534), also from the young trees; the third (2514), a piece of machine sheet from the older trees. A sample of thick crêpe from 7-year-old trees gave a tensile strength of 2,400 lb. per square inch, the highest for that grade. The tensile strength of the rubber prepared with acetic acid is slightly higher than that of the rubber prepared with hydrofluoric acid (puruh):—

XI.

| | | | Tensile Strength. | Ratio. |
|-------------------|-----|-----|----------------------|--------|
| Acetic acid | ... | ... | 2369 | 100 |
| Hydrofluoric acid | ... | ... | 2307 | 97 |

XII.

| | | | Elongation. | Ratio. |
|-------------------|-----|-----|-------------|--------|
| Acetic acid | ... | ... | 874 | 100 |
| Hydrofluoric acid | ... | ... | 880 | 101 |

COMPARISON WITH HARD PARA.

Standard samples of hard fine Para were tested under the same conditions with the following results, the figures for sheet in Table IX. and crêpe in Table X. being reproduced for comparison:—

XIII.

| | | | Tensile Strength. | Ratio. |
|-------------------|-----|-----|----------------------|--------|
| Sheet | ... | ... | 2386 | 100 |
| Fine Hard Upriver | ... | ... | 2276 | 95 |
| Do. Acre | ... | ... | 2312 | 97 |

XVI.

| | | | Elongation. | Ratio. |
|-------------------|-----|-----|-------------|--------|
| Crêpe | ... | ... | 883 | 100 |
| Fine Hard Upriver | ... | ... | 893 | 101 |
| Do. Acre | ... | ... | 830 | 100 |

RETARDATION OF COAGULATION.

Effect of adding (a) ammonia, (b) sodium sulphite, and (c) formaldehyde.

Ammonia.—A 2 per cent. solution of ammonia was added to the latex with stirring, until a slight alkaline reaction was obtained. Latex had almost completely coagulated in 24 hours.

Sodium Sulphite.—A 10 per cent. solution of sodium sulphite was added till the latex contained approximately 0.2 per cent. sodium sulphite (crystals). In 24 hours the latex showed signs of putrefaction; a small quantity had coagulated.

Formaldehyde.—Formalin was added until the latex contained 0.5 per cent. of formaldehyde. In seven days only a very small amount of coagulation had taken place, and no odour of decomposition was observed.

All the rubber was made into sheet.

XV.—*Latex from 7-year-old Trees*

| | Time. | Ratio. | | Tensile Strength. | Ratio. | | Non- gation. | Ratio. |
|--|-------|--------|-----|----------------------|--------|-----|-----------------|--------|
| Control ... | 60 | 130 | ... | 2380 | 100 | ... | 874 | 100 |
| Ammonia (latex coagulated same day ... | 70 | 85.7 | ... | 2350 | 98.7 | ... | 887 | 101.4 |
| Sodium Sulphite (latex coagulated same day) | 75 | 80 | ... | 2348 | 99.4 | ... | 861 | 98.5 |
| Formaldehyde (latex coagulated after 24 hours) ... | 107 | 56 | ... | 2250 | 95.1 | ... | 863 | 98.7 |

Formalin increases considerably the time required for vulcanization, while it reduces the tensile strength.

XVI.—*Latex from 16 to 20-year-old Trees.*

| | Time. | Ratio. | | Tensile Strength. | Ratio. | | Non- gation. | Ratio. |
|---------------------|-------|--------|-----|----------------------|--------|-----|-----------------|--------|
| Ammonia ... | 77 | 100 | ... | 2440 | 100 | ... | 896 | 100 |
| Sodium Sulphite ... | 73 | 105.5 | ... | 2402 | 98.4 | ... | 892 | 99.5 |
| Formaldehyde ... | 106 | 73.3 | ... | 2358 | 96.5 | ... | 874 | 95 |

All samples coagulated the same day. Control omitted, as rubber was rather under-vulcanized. Formalin comes out lowest in every respect.

SPONTANEOUS COAGULATION.

Samples were prepared from three sources; rubber which coagulated in cups and buckets (clot); scrap from trees; and latex allowed to stand till coagulation occurred and rolled into sheet. The clot was in the form of

irregular sheet. They are compared with the controls from Tables I., II., and III., the specimens in all three tables thus becoming comparable:—

XVII.—*Latex from 7-year-old Trees.*

| | | | Time. | Ratio. | | Tensile Strength. | Ratio. | | Elong- gation. | Ratio. |
|------------------------|-----|-----|-------|--------|-----|----------------------|--------|-----|-------------------|--------|
| Control | ... | ... | 75 | 100 | ... | 2018 | 100 | ... | 873 | 100 |
| Clot | ... | ... | 80 | 125 | ... | 1909 | 94.6 | ... | 861 | 98.6 |
| Scrap | ... | ... | 75 | 100 | ... | 1623 | 80.4 | ... | 797 | 91.3 |
| Latex allowed to stand | | | | | | | | | | |
| till coagulated | ... | ... | 50 | 150 | ... | 2170 | 107.5 | ... | 875 | 100.2 |

XVIII.—*Latex from 16 to 20-year-old Trees.*

| | | | Time. | Ratio. | | Tensile Strength. | Ratio. | | Elong- gation. | Ratio. |
|------------------------|-----|-----|-------|--------|-----|----------------------|--------|-----|-------------------|--------|
| Control | ... | ... | 75 | 100 | ... | 2293 | 100 | ... | 876 | 100 |
| Scrap | ... | ... | 65 | 115 | ... | 1425 | 62.1 | ... | 883 | 100.8 |
| Latex allowed to stand | | | | | | | | | | |
| till coagulated | ... | ... | 60 | 125 | ... | 2250 | 98.1 | ... | 865 | 98.7 |

Sample of clot too small for tests.

Both clot and scrap were inferior in tensile strength compared with first latex specimens; in the time of curing they were good.

REMARKS.

1. The specimens were generally of excellent quality.
2. Acetic acid gave as good results as any other acid used; a slight excess had no marked adverse effect.
3. The average value of the tensile strength of 41 samples tested was 2,342 lb., a higher figure than that of the two standard samples of hard Para.
4. The principal variation which the rubbers show is not in tensile strength or elongation, but in time of cure, which ranged between 50 and 122 minutes. These differences may be of great importance to the manufacturer.
5. The addition of formalin to the latex considerably increased the time of cure; ammonia and sodium sulphite had much less effect.
6. Machining increased the time of cure.
7. Creping reduced the tensile strength of rubber, but not to a great extent.
8. The tensile strength of scrap and clot was low, the time of vulcanization good.

REMARKS.

1. The results recorded in this summary confirm those previously obtained in showing that plantation Para rubber is quite satisfactory in mechanical properties, the average tensile strength being fully equal to that of specimens of best hard Para and the average elongation at the breaking point only very slightly lower.

2. The chief variation, as in the case of the previous specimens, is in the time required for correct vulcanization. There is no doubt from the results now available that the conversion of the freshly-coagulated rubber into crêpe lengthens the time of vulcanization, as compared with that of the corresponding sheet. In eleven comparative sets of specimens dealt with in this summary the thin crêpe rubber had a distinctly longer time of vulcanization than the sheet, the figures ranging from 105 to 130 minutes for the crêpe and from 60 to 75 minutes for the sheet. It is noteworthy, too, that this lengthening of the time of vulcanization is brought about by passing the rubber through the rollers only 5 or 7 times and that additional treatment in the machine, up to 70 times through the rollers, has little further effect on the time of vulcanization. Thus, the times of vulcanization of crêpe rubber passed through the rollers 7, 35, and 70 times were 113, 115, and 130 minutes, and the times for rubber treated 5, 25, and 50 times were 105, 115, and 115 minutes respectively (Section X., Series I. and II.); the time for the control sheet was 75 minutes in each case.

3. Although the conversion of freshly-coagulated rubber in crêpe has this marked effect on the time of vulcanization, the tensile strength is again shown to be but little affected, the difference in the breaking load of the sheet and crêpe being only small. In the specimens previously dealt with (Sections V. a, V. b., VI. a, and VI. b) the advantage in average tensile strength was invariably in favour of the sheet, but the crêpe may have the higher value, as is the case in four of the six sets of specimens in Sections VII., VIII., VII. r, and VIII. r. In Sections IX., IX. r, and X., however, the sheet is always distinctly stronger than the crêpe, and the difference in three cases is for some reason larger than usual.

4. The "over-working" of the freshly-coagulated rubber in the washing machine (Section X.) had little effect on the tensile strength or on the time of vulcanization. Rubber passed through the rollers 50 or 70 times differed only slightly in either of these respects from rubber treated 5 or 7 times. The common opinion that the mechanical properties may be easily impaired by "over-working" does not receive support from the results of these experiments.

5. The conversion of thin crepe into thick crepe, by rolling several pieces together, did not produce any difference in the time of vulcanization, and the differences in tensile strength were not very marked or constant. The block rubber, made by compressing thin crepe, had the same time of vulcanization as the latter, but in five out of six sets of specimens its tensile strength was a little lower.

6. The different methods of drying employed in Sections IX. and IX. r—(1) air-drying at the ordinary temperature, (2) drying in hot air, and (3) in vacuo—had very little effect on the time of vulcanization or tensile strength of the rubber.

FUNGOID DISEASES OF HEVEA BRASILIENSIS.

Root Diseases.

In all cases of attack on *Hevea Brasiliensis* by any root disease the object of the treatment is primarily to protect the surrounding healthy trees. It is only occasionally that an attacked tree can be saved.

It is to be remembered that by the time any one tree is so far affected by a fungus attacking the roots that the tree shows visible signs of the disease, several of the surrounding trees will also have been attacked.

Visible Signs of Root Disease General for all Root Diseases :—

- (1) Diminution or complete cessation of latex flow.
- (2) The leaves of the tree wilt and the crown of the tree is thin.
- (3) After wintering the new foliage appears on adventitious shoots.
- (4) Irregular flower and fruit formation.
- (5) Trees are blown down by strong winds.

A tree showing any of the above signs should have its roots exposed and examined. The particular fungus causing the disease can, as a rule, be determined by the following signs.

A. *Fomes Lignosus* (*Fomes Semitostus*).

The exposed roots are covered with a white feathery growth and white velvet like ribbons along the roots. The growth and ribbons adhere firmly to the bark.

N. B.—Many harmless fungi give white growth on roots of trees, these however usually do not adhere firmly to the roots.

(2) In favourable weather the fructification of the fungus is found on a neighbouring dead stump or wet rocks or on the dying tree.

The fructification is concentrically ringed on the upper surface with alternate reddish brown and light brown lines. The edge of the plate is white to yellow, and the under surface is a deep ochre yellow in colour. When the plate is broken across the lower half is brown with thin tubes at right angles to the white upper half of the plate. This last is shown by very old fructifications and is characteristic of *Fomes Lignosus*.

The fructification does not always form a bracket but may occur as a flat incrustation with the ochre yellow, pore bearing side exposed to view. This is not very common.

B. *Ustulina Zenata*.

(1) The root or roots are rotten, the decayed wood being dry and tindery with irregular black lines in it. The black line is very definite and looks as if it had been marked in with Indian ink. The rot carries along the heart of the root.

(2) The fructification forms flat on the surface of the root or stem of the tree. In colour it is at first white with a greenish tinge, the advancing edges of the fructification are white. Colour changes occur in it as it becomes old, through grey to mottled grey and finally black. When black the fructification is brittle and the fractured edge shows small flask-shaped cavities just beneath the outer layer.

C. *Hymenochaete Noxia*.

(1) The exposed roots, especially the tap root, will be found to be encrusted with an aggregation of earth, sand and small stones bound together by brown threads.

(2) The fructification is not often found but is a thin brown crust at the bottom of the stem.

D. *Sphaerostilbe Repens*.

(1) The exposed roots show nothing until the cortex is removed when black or red ribbon like strands are found on the surface of the wood.

(2) The fructifications are produced in cracks in the bark and consist of short red stalks bearing the spores.

***Peria Hypobrunnea*.**

(1) White fine mycelium on the roots turning to brown in the older stages.

(2) Red brown plates in the decaying wood.

(3) Fructifications seldom occur but may form on dead trees as a white incrustation which turns red brown later.

(4) The Straits Mycologist describes a wet rot of the wood as typical of the Straits *Poria* but Petch makes no mention of this as regards *P. Hypobrunnea*.

Treatment of Root Diseases.

Root diseases must be treated thoroughly and drastically. Any neglect in the work will lead to further trouble and expense.

The work necessary is as follows:—

(1) The attacked tree or trees to be removed entirely from the ground; the roots must be followed to their extremities. All wood and roots from the tree must be burned on the spot.

(2) The extremities of the roots of the diseased tree or trees define the position of the isolation trench. The trench must be cut at least 30 inches deep.

(3) All surrounding trees should be examined by exposing their roots.

(4) Guard trenches should be cut round suspected trees outside the main trench.

(5) The earth from the trench must be thrown inside it, and then the isolated area forked over deeply, removing from the ground and burning all roots and dead stumps.

(6) Lime at the rate of 60 lbs. a tree must be forked in.

(7) If the diseased tree is on land full of old Tea stumps, it is advisable to remove and burn all such for a considerable distance around the infected area.

The root diseases most difficult to control are those which can spread by mycelium through the ground. The difficulty is increased when the infection is in rocky hillside land. In these cases it is often difficult to get in a trench. Further when the trench is cut, surface wash rapidly fills in the trench at the top and bottom of the area, here much can be done by terracing above the trench.

In all cases the trench must be kept to its original depth, otherwise the mycelia may spread from the infected area to the healthy surrounding area through the silted trench.

Areas infected by *Fomes Lignosus* must be watched constantly and any trees outside the main trench showing signs of attack must be removed and any suspicious trees examined.

STEM DISEASES.***Phytophthora Faberi*. "Canker,"****1. Visible Signs,**

Fresh infections are difficult to detect and it is only at a late stage that the disease is noticed. The following signs have, in the majority of cases, led to the detection of "Canker":—

- (a) Exudation of reddish brown fluid.
- (b) Exudation of latex from a burst in the bark.
- (c) Local attacks by boring insects.
- (d) Roughening of the bark.
- (e) Cessation of latex flow.
- (f) Cracking bark.

In a case of fresh infection after scraping away the outer corky layer the bark appears dark and sodden; active infections at a later stage show discolouration varying from neutral grey to a brown colour: the tint of the discolouration deepens on exposure to air.

The fungus is active in wet weather; in dry weather the healthy bark beneath the infected tissue forms a corky layer which cuts out the infection, however the disease remains dormant in the dead tissue and re-infects during the next wet weather.

In examining trees it has been found that only the most severe attacks become immediately evident. The time to examine for the disease is in the dry weather between the monsoons:—

- (a) August and September.
- (b) February and March.

The latter period is the better.

Treatment.**(1) Preventive Measures.—**

Spraying or painting the Stems,

- (1) With Bordeaux Mixture is effective, but the danger of contaminating the latex with Copper Salts prohibits its use.

(2) Treatment of infected Bark.—

The diseased bark must be completely excised; surface scraping is useless, the diseased bark is dead and nothing can make it again become healthy tissue.

If the wood of the trees is exposed coal tar is applied to it, leaving a strip at the edge of the wound.

NOTE.—The application of Coal Tar to lightly scraped "Canker" infections is dangerous, the fungus continues to thrive beneath the tar.

In practice, as recently attacked tissue is scarcely discoloured, the first scraping may fail to remove all diseased tissue; however if the scraped patch is left open, in dry weather these remaining diseased pieces of bark crack out, and a second scraping will remove all. Two thorough scrapings each year are necessary.—

This treatment, though possibly tending to a reduction in the number of fresh infections, cannot prevent them, and as each year there will be some new attacks, yearly scraping is essential. For this work estates should have a properly trained gang of coolies.

In addition to scraping out "Cankered" bark the stem of the tree should be lightly groomed, removing moss and accumulations of corky and scaly bark. Care should be taken in doing this work, not to expose the living cortex.

Branches attacked by Canker should, if strong enough to bear a cooly, be treated in the same way as the stem. Small branches badly attacked should be pruned out, the pruning being correctly done by cutting off the branch level with the main branch or stem; the wound made is tarred.

BARK ROT ON THE TAPPED SURFACE.

CAUSED BY PHYTOPHTHORA.

Visible Signs.

Black lines running vertically in the tapped bark; in bad cases the entire exposed tissue dies. The black lines may extend upwards and downwards from the tapped surface. In some cases rubber pads have been found beneath the dead bark.

TREATMENT.

PREVENTIVE MEASURES.

Before the Monsoons begin to apply a mixture of Tallow 95% and Tar 5% (by weight) to the tapping surface. All that is necessary is to give the tapped area a water-proof coating. To ensure the best results the application of the mixture must be regular and kept up to date.

Rutgers recommends the application of a 20% solution of Carbolineum Plantarium at intervals of four or five days during the season of attack.

The correct treatment is to prevent attack, slight attacks may stop after treatment with the above named substances, there are however some cases which are very persistent and once they have got a hold are difficult to stop. In these cases the black line characteristic of the attack is found to have penetrated into the wood. Whilst slight attacks are checked by dry weather these continue to spread. In such cases cessation of tapping and the excision of all dead tissue with proper precautions to protect the wood should be tried.

POD DISEASE AND LEAF FALL IN SOUTH-WEST MONSOON.

PROVED DUE TO PHYTOPHTHORA.

Visible Signs.

(a) Fruit pods develop sodden patches on which a white mould may appear, then blacken and dry on the trees without dehiscing.

(b) The fungus spreads in two ways causing leaf fall :—

(1). Direct infection on the leaf stalk, the fallen leaves then have a brown patch on the petiole to which at times a pellicle of rubber adheres.

(2). The Mycelium of the fungus runs back through the fruit stalk into the branches, killing the branch and so the leaves fall.

Prevention of this form of Phytophthora attack is difficult. Removal of the flowers and of the green fruits has been proved impracticable, on account of the difficulty of removing the flowers and fruits from the upper branches and the seasonal requirements of additional labour.

Macrae has stated that the resting stage of the fungus is in the branches attacked, and these, if allowed to remain on the trees, will carry on the disease from year to year.

In order to prevent this carrying on an attempt should be made to remove dead branches and pods.

Although in most Districts of Ceylon leaf fall occurs the attack is apparently less severe in good well cultivated soil.

Stem "Canker," Bark Rot on the tapped surface and leaf fall in the South-West Monsoon by themselves do great damage; but, since they leave the tree in a wounded condition, the possibility of attack by fungi entering the tree at wounds occurs. Two such fungi are known to attack *Hevea Brasiliensis* :—

(1). *Ustulina Zonata*.

(2). *Botryodiplodia Theobromæ*.

Ustulina Zonata has already been described as a root disease, it can also attack the tree through wounds on the stem and branches. Danger of attack by this fungus makes it necessary that all "Canker" scraping must be carefully done and also any pruning of branches should be correctly performed. Broken branches and remnants of incorrectly pruned branches have served as points of entry for the fungus.

Treatment.

Only when the attack is detected in the early stages can the tree be treated. Treatment is the excision of all the diseased tissue in the bark and wood of the tree, followed by the usual precautions.

BOTRYODIPLODIA THEOBROMAE.**Visible Signs.**

(1). The disease attacks the leading shoots and travels down the tree killing each branch it encounters on its passage.

(2). A side branch is attacked and the disease travels down this side of the tree.

The fructification of this fungus is found in the bark, and when ripe the spores come to the outside of the bark covering it with a black powder-like soot.

Treatment.

Usually trees attacked by this disease will be found to be in a group. Drastic treatment is necessary, the diseased part being pruned away, and the wounds well tarred. This fungus runs very rapidly down the tree, and unless dealt with immediately the tree is usually lost.

PINK DISEASE. CORTICIUM SALMONICOLOR.**Visible Sign.**

This disease is usually first seen at the fork of the tree or adjacent to the off shooting of several closely placed branches. The bark becomes covered with a pink film. In dry weather the bark of the attacked tree cracks down to the wood.

Treatment.

The portions attacked must be excised and the wounds covered with tar. Care must be taken that the pruning is done well below the diseased parts. The dead wood and bark must be burned.

Attack can be prevented by spraying the forks of trees with Bordeaux Mixture, all scaly bark being removed before the spraying is done.

In conclusion, only the most frequently occurring fungi have been dealt with here. For further information readers should refer to more fuller treatises on the subject.

The question of protecting the trees from fungoid diseases is of great importance to the Rubber Planter. General methods of Plant Sanitation will help to remove the danger of attack.

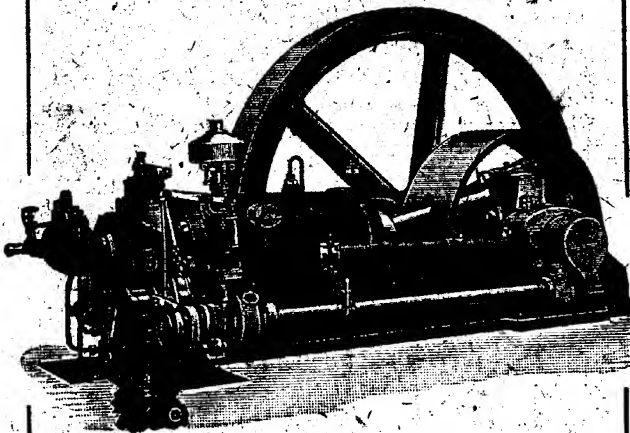
As an instance *Ustilina Zonata* which can be both a root and stem disease, will usually be found on old logs and stumps on the land, the destruction of these is essential. Similarly the hosts and intermediary

hosts of the known diseases must be destroyed. Such work is at first always expensive, but regularity in executing it leads ultimately to a low cost in the same way as regular weeding reduces the cost of weeding. Every estate should have a number of coolies trained to recognise and treat diseases, of course under proper supervision. In the case of root disease a record of the part of the estate where disease has occurred should be kept, so that with change of Superintendents such areas can be kept under observation.



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CULTIVATION AND MANURING.

By P. A. KEILLER, F.C.S., ANALYTICAL CHEMIST,

COLOMBO COMMERCIAL CO.

SOIL CONDITIONS.

The cultivated soils of Ceylon, other than those of paddy fields consist, generally speaking, of the weathering products of gneiss and quartzite schists. They are nearly always the results of decomposition of the original rocks *in situ* and are but rarely formed by deposition from water.

A great many analyses of Ceylon soils have been made during the past 10 or 20 years, and a study of them reveals one or two points in which they differ from the average cultivated soils of temperate climates. Of these, the most striking are the much smaller percentages of lime and phosphoric acid. Lime is the base which is most rapidly leached out of a soil, and Ceylon's heavy rainfall and comparatively high temperature have had the effect of depleting the soil of lime to a marked degree. This has resulted in a higher percentage of magnesia than lime in most Ceylon soils, a condition which is seldom met with in temperate climates. It should not, however, be assumed because of this that all Ceylon soils need lime. A low lime-content is the normal condition of Ceylon soils (and indeed of most tropical soils) and the vegetation native to the island thrives under this condition; its requirements should not be judged by those of temperate crops. Ceylon soils may or may not be improved by lime, but the fact that they normally contain very little is no *prima facie* evidence that they will be.

Phosphoric acid is not readily washed out of a soil, but the soil-forming rocks of Ceylon are naturally poor in this constituent, and the majority of our soils have probably never had any great store.

As regards the other constituents, the same variations are found among Ceylon soils as among those of other countries. Potash, for instance, is high in those containing much potash-bearing felspar or mica, and may be low where these minerals are absent. Nitrogen, similarly, is usually high in soils containing much organic matter, and low in quartzite ridges where organic matter does not readily accumulate.

On the whole, the chemical composition of Ceylon soils is poor compared with those of higher latitudes, and it is more to our climate than to our soils that we owe the luxuriant growth which is associated with the Tropics.

Of equal importance with the chemical composition of a soil is its physical condition. On this depends its power of retaining moisture and of absorbing fertilisers, and also its temperature and state of aeration. These last, in turn, largely determine the nature and vigour of its bacterial life. In general terms, a soil to be in good condition should have its surface loose so as to allow the free entrance of rain-water and air and to prevent evaporation during dry weather, while its subsoil should be sufficiently compacted to promote the capillary rise of subsoil moisture to the neighbourhood of the roots. This state of affairs can only be attained by constant cultivation.

That a loose surface does prevent loss of subsoil moisture is shewn by the figures in Table I. The samples were drawn from a clean-weeded cultivated plot and from a well-trodden road adjoining it. The soil was naturally hard and gravelly and would be described as "cabooky." The plot had been regularly cultivated for two years and the surface was soft and friable, while the road was extremely hard, with only a few small gravel stones on the surface. The distance between the two points of sampling was less than 20 feet. No rain had fallen for 27 days previous to the sampling. Moisture was found as follows:—

TABLE I. Moisture in Cultivated and Uncultivated Soils.

| | Cultivated Soil. | | Road. | |
|--------------------------|------------------|-----------|-------|-----------|
| Moisture in surface inch | 1·10 | per cent. | 4·82 | per cent. |
| " at 6" below surface | 10·65 | do | 11·71 | do |
| " " 12" " " " | 13·20 | do | 10·96 | do |
| " " 24" " " " | 13·37 | do | 10·24 | do |

It will be seen that there is a steady increase in moisture with increasing depth in the cultivated plot, whereas in the road the greatest accumulation of moisture is at 6 inches below the surface. From this point it decreases with the depth, shewing that the subsoil is being depleted by evaporation at the surface. The surface of the cultivated plot is drier than that of the road because the capillary rise is stopped by its being loose, and it receives no moisture from below. There is a much greater rise in moisture content in the first six inches of the cultivated soil than of the road.

In the cultivation of Ceylon crops whose roots are mostly at a greater depth than six inches, the importance of maintaining a loose surface to prevent the drying out of the subsoil is very apparent.

Forking done in wet weather should be deep enough to penetrate below the limits of the hard surface soil (if any), and in dry weather should be light, for the purpose of maintaining three or four inches of loose dry soil on the surface.

Light dry-weather forking should be followed by deep forking at the beginning of the rains, otherwise the surface soil will be in danger of being washed away, so long at least, as any hard stratum exists below the forked surface.

Besides cultivation (in the sense of tillage), green-manuring and liming are useful aids to the improvement of soil condition under suitable circumstances.

Soil Analysis.

The analysis of soils is carried out in Ceylon to an extent unknown in any other agricultural country, and it is very doubtful whether the results are commensurate with the time, trouble, and expense involved. The chemical control of soils in the same manner as that of manufacturing processes is impossible, and any attempt to arrive at such control by a multiplicity of soil analyses is a mere waste of time. Soil conditions are so varied, and many of them so completely outside our control that the decisive factor in the fertility of any particular soil is very seldom revealed by a determination of plant-food percentages. It is true that by employing special methods, involving much time and labour, a good deal of information may be obtained regarding the fertilisers likely to suit a particular crop on the soil in question, but work of this nature is only suited to experimental or research stations where the previous history of the soil is accurately known and where the analyst has plenty of time at his disposal; they are useless for what might be termed the technical control of soils. The methods usually employed in Ceylon have the merit of giving results without much loss of time, but it would be hard to find any other merit which they possess. The deductions that can fairly be drawn from them are few, and their aid in the choice of a fertiliser is in reality almost nil.

The interpretation of soil analyses is a matter of the greatest difficulty even when they have been conducted under the most favourable conditions, and it should never be attempted without a knowledge of the methods employed and of the previous treatment and general history of the field.

It is frequently stated that for the best results, each field which is to be manured should be treated on its own merits after its soil has been

analysed. Theoretically, this is correct ; practically, it is not. It would be correct were it possible to determine by soil analysis the exact composition of the fertiliser best suited to the crop, but in the present state of our knowledge this is not possible. The most complete soil analysis ever made can do no more than suggest a system of manuring that is likely to be successful. The ultimate adoption of the system will depend on the result of actual trial.

The only information of value which can be obtained from a rapid examination of a soil relate to its general physical condition, nitrogen and humus content, and to a certain extent its need for lime.

What is wanted in Ceylon is the classification of soils under certain broad types, the productiveness of which for different crops is known. The classification should be by physical as much as by chemical properties, and while involving an immense amount of labour in the first instance, would make possible the subsequent investigation of soils on a scientific as well as a practical basis.

Crop Analysis.

Just as soil analysis is often misleading so is crop analysis when one seeks by this means to discover the fertiliser required. No greater mistake can be made than to assume that the plant-food required in the form of a fertiliser can be calculated from that removed by the crop. Liebig's theory of plant nutrition, which is the basis of all such assumptions, has long ago been shewn to be incorrect and it cannot be too definitely stated that the analysis of a plant is not a guide to the fertiliser it requires. The fact that a plant removes a large amount of phosphoric acid, for instance, from the soil is no indication that it will respond to phosphatic fertilisers. It may or may not do so, and its analysis affords no clue. It not infrequently happens that the element which is found in *least* quantity in the ash of the crop is that which it has greatest difficulty in obtaining from the soil, and to which as a fertiliser, therefore, it responds most readily. But this can no more be correctly assumed for all cases than can the reverse.

To give ~~one~~ of the many reasons for the failure of Liebig's theory, a soil may have a marked power of fixing phosphoric acid in such a form that the crop cannot utilise it. It may, therefore, need the addition of very much larger quantities of this plant-food than are removed by the crop before any beneficial effects are found. Again, the use of this large amount of phosphate may so modify the condition in which potash, for instance, exists in the soil that the crop can obtain all the potash it requires and remove large quantities from the soil without responding in the least to potash fertilisers.

Green Manuring.

By green manuring is meant the incorporation with the soil of organic matter derived from the leafy portions of a growing plant. The plants usually employed for the purpose are those of the order *leguminosæ* because they have the advantage of assimilating nitrogen from the air and thus increasing the store of nitrogen in the soil when they are returned to it. The essential feature of green-manuring is, however, the addition of organic matter to the soil, and the use of *leguminosæ* is not essential; the burying of tea prunings, or of rubber leaves, for instance, is an extremely useful form of green manuring.

It is sometimes assumed that green manuring is effected merely by the planting of leguminous trees or shrubs and that nothing further requires to be done once they are established. Such a procedure certainly enriches the soil to some extent by reason of the atmospheric nitrogen which is assimilated by the bacteria associated with the roots of these plants, but the gain is small, while the main object of green-manuring—the addition of large quantities of organic matter to the soil—is entirely lost. The planting of *leguminosæ* does not constitute green-manuring. It is merely a preliminary operation to enable green-manuring to be carried out by subsequent burying of the leafy portions of the crop.

There are differences in the amounts of nitrogen contained in the green material from various *leguminosæ* and the following table, compiled from figures published in Circular No. 17, Vol. V, of the Royal Botanic Gardens, Peradeniya, gives some of the figures:—

TABLE II. Nitrogen in Leguminous Plants.
(SUN-DRIED SAMPLES.)

| | |
|---|----------------|
| <i>Acacia decurrens</i> | 2.16 per cent. |
| <i>Albizia moluccana</i> | 1.13 do |
| <i>Crotalaria striata</i> | 3.80 do |
| <i>Erythrina lithosperma</i> (Dadap) | 2.48 do |
| <i>Tephrosia candida</i> (Boga-medelloa) | 2.80 do |

These figures are interesting, but are of only secondary importance in deciding which crop is to be grown; obviously, the most important point is the suitability of the crop to the district in question.

The following, from the same source as the above, are the elevations at which these leguminosae have been successfully cultivated.

| | |
|--|--|
| <i>Accacia decurrens</i> ... | Above 4,000 ft. which is rather too high for dadaps and albizzias. |
| <i>Albizzia moluccana</i> ... | From sea-level to over 4,000 ft. growing quicker at the lower elevation. |
| <i>Crotalaria striata</i> ... | From sea-level to 4,000 ft. and is most successful in those parts of the Island which depend chiefly on the north-east monsoon for their rainfall. |
| <i>Erythrina lithosperma</i> (Dadap). ... | Best at about 1,600 ft. but grows well in some districts up to 4,000 ft., especially on the drier Uva side. |
| <i>Tephrosia candida</i> (Boga-medelloa) ... | Grows luxuriantly from sea-level to 3,000 ft. |

The point of next importance is the weight of green material obtained for burying. This varies so much with conditions of climate, age of the green crop, etc., that such figures as are available are of little value. In general it may be said that *crotalaria*, *dadaps* and *Boga-medelloa* are heavy yielders, *albizzias* and *accacias* being less so. *Boga-medelloa* is perhaps the favourite green manure at the present time, especially at low and moderate elevations. It grows quickly from seed, gives heavy crops of leafy material, and can be grown even under moderate shade. Where vacancies or infertile patches occur in rubber it has been planted successfully, and much good could in this way be done to many rubber soils suffering from lack of organic matter.

The necessity for green manuring in Ceylon becomes apparent when ordinary farming practice in European countries is contrasted with that on Ceylon estates. In temperate climates land is kept in condition by

frequent and liberal applications of farmyard manure, the necessary concentration of plant-food required for heavy crops being supplied by comparatively small doses of artificial fertilisers. So important does the European farmer consider the dunging of his land that a fair head of cattle is looked upon as a necessity on the farm quite as much on account of their manure as of the milk, butter, etc., which they also yield. In some cases, indeed, the manure is considered the most important product, and the cattle are fed with a view to increasing its quantity and richness. In Ceylon, cattle do not form part of the average estate equipment. Cattle manure is scarce and its use the exception rather than the rule, and the land gets no return for the wastage in organic matter under cultivation, a wastage that goes on much more rapidly in the tropics than in colder climates. The deterioration of land under these conditions is certain, and cannot be altogether prevented by the use of artificial fertilisers, even on the large scale on which they are used in Ceylon. One obvious remedy is for estates to carry sufficient head of cattle to supply their land with manure. The objections to this are the scarcity of grass lands and the expensiveness of imported cattle foods, besides the difficulty of transporting bulky manure in sufficient quantities by coolie labour.

The alternative remedy is green-manuring. While cattle cannot be fed on fields of tea and rubber, green manures can be grown there without interfering with the permanent crop, and the planter should look upon his green manure crops in the same way as the Home farmer looks upon his cattle—as essential to the permanent upkeep of the estate by virtue of the organic manure they supply.

MULCHING.

This operation, sometimes confused with green-manuring, consists in covering the surface of the ground with a layer of material to protect it from the drying action of sun and wind. The nature of the material used varies very greatly. The layer of loose earth which results from cultivation is a mulch. Fallen leaves on the surface of the ground are a mulch. Tea prunings left unburied form a mulch. Stones, even, act as a mulch when on the surface, and coconut shells arranged around trees are another form of mulch. Under all these the ground will be found more moist in dry weather than at adjacent spots which are free from them. The purpose of mulching is to conserve soil moisture, not to increase the organic matter in the soil which is the primary object of green-manuring.

Mulching other than the maintenance of a loose layer of surface soil has its uses, but may do more harm than good if indiscriminately

practised. Its chief value lies in its application to short-lived crops whose roots are mostly near the surface, for its tendency is to encourage surface roots, and this tendency makes mulching bad practice under certain conditions.

Surface rooting should be discouraged in all permanent crops. Roots upon the surface are a sign of lack of cultivation and they interfere greatly with cultivation should an endeavour be made to improve the soil's condition. They interfere equally with the application of manure and are liable to mechanical injury at all times. Worst of all, they suffer severely when dry weather sets in, and their sufferings reflect seriously on the vitality of the crop.

Generally speaking, and referring to crops which occupy the land permanently, a mulch should not be laid down on an unforked surface. It can be seen that for many reasons a mulch applied to an unforked surface is not so effective as a loose layer of surface earth in conserving moisture. It seldom covers the surface completely, and is liable to be disturbed by wind or other agencies. Being raised above the normal surface air circulates freely through it and carries off a considerable proportion of the moisture which rises to the hard surface of the earth beneath it, so that while this surface remains fairly moist, the subsoil gradually dries. The conditions just below the mulch are, therefore, very favourable to root development, and the majority of the roots find their way there in search of air and moisture. If for any reason the mulch disappears (and this invariably happens in practice) these roots are exposed, they dry up quickly, and the crop may suffer a severe set-back.

A mulch laid down on a forked surface is an additional safeguard against loss of moisture, and affords a certain amount of protection against the beating down and compacting of the soil by rain or by the feet of coolies employed in the field. It should not, however, be left indefinitely but should be dug into the soil when the next round of cultivation falls due.

It is not infrequently stated that growing grass and weeds prevent loss of soil moisture by forming a mulch to shade surface. This is not the case. A grass-grown soil loses moisture more rapidly than a clean-weeded cultivated soil, the loss by transpiration of the growing grass more than exceeding the gain through any shading of the surface.

In Table III are given some figures of soil-moisture at different depths in a clean-weeded and grass-grown plot respectively. The two plots adjoined one another, and the points of sampling were less than 20 feet apart. No rain had fallen for 27 days previous to sampling.

TABLE III.

Moisture at different depths in Cultivated and Grass-grown land.

| | Cultivated. | Grass-grown. |
|---------------------------|-------------|--------------|
| Moisture in surface inch | 0.98 % | 1.81 % |
| „ 6 inches below surface. | 8.58 „ | 5.57 „ |
| „ 12 „ „ „ | 9.74 „ | 6.78 „ |
| „ 24 „ „ „ | 9.91 „ | 6.42 „ |

These figures shew the same characteristics of those in Table I, a steady increase in moisture at different depths in the cultivated soil and a decrease with increasing depth in the case of the grass-grown soil. With the exception of the surface, all the figures for the grass-grown soil are less than at the corresponding depths in the cultivated soil, which makes it likely that the grassed plot is losing moisture more quickly even than it would if kept clean-weeded and without a cultivated surface. The soils of Table I and Table III are not of the same nature, and so the Tables cannot be directly compared.

Dead grass lying on the surface is an effective mulch, but growing grass is not.

LIMING.

Lime is the product obtained by burning limestone, coral, shells, etc. Its chemical name is calcium oxide.

The following list of the various forms in which lime may occur and of some of the compounds from which it is made may be found useful:—

| | | |
|----------------|---|---|
| Lime. | { | These are all the same and represent the product obtained by burning lime stone, coral, shells, etc. The chemical name for all these forms is calcium oxide. |
| Quicklime. | | |
| Burnt lime. | | |
| Caustic lime. | | |
| Unslaked lime. | { | This is formed by the addition of water to any of the above. Its chemical name is calcium hydroxide. |
| Slaked lime. | | |
| Boiled lime. | { | This has the same composition as slaked lime but the slaking is done with boiling water and the resulting product is obtained in the form of soft white lumps of pasty consistency. It is used for white washing. |
| | | |

Limestone.
(Unburnt lime.)
Chalk.

These are the same. Limestone and chalk occur as rocks and are the commonest sources of lime in other than Tropical countries. Their chemical name is calcium carbonate, but when in the form of limestone this is nearly always associated with more or less magnesium carbonate.

Coral and most sea-shells are a pure form of calcium carbonate and are much used in Ceylon for making lime.

Whiting.

This is not often met with in Ceylon but may be mentioned to prevent confusion of names. It is made from the purest chalk, washed, ground to very fine powder with water, and made up into balls. It is, therefore, a form of calcium carbonate. It is used for the best whitewashing, but in Ceylon its place is taken by the "boiled" lime already described.

For agricultural purposes in Ceylon, lime is applied either slaked or unslaked. In the form of slaked lime it possesses several practical advantages. It is less unpleasant to handle, having no caustic or burning action; it is in the form of fine powder, free from lumps of over-burnt or under-burnt lime which will not slake, and it can therefore be distributed much more easily; also it has much less destructive action on organic matter and humus in the soil.

Unslaked lime, applied in quantities of from 3 to 5 tons per acre, produces a partial sterilisation of the soil, akin to the action of heat, and this action is not shared by lime applied in the slaked form. But for the purpose of correcting acidity, improving tilth, and promoting the decomposition of potassium silicates the action of slaked lime is the same as that of unslaked.

Lime exists in Ceylon soils chiefly combined with silica as silicate of lime. In soil analyses this is usually stated as "Lime," but does not mean that any of the forms of lime enumerated above exist in the soil. It merely represents the amount of lime which would be obtained from the silicates of lime (or other lime compounds) in the soil if the silica were removed.

CATTLE MANURE.

Cattle manure is not looked upon by the average Tea or Rubber planter as one of the fertilisers at his disposal, but in the case of a few up-country estates it is made fairly extensive use of, while it is held in high favour by most coconut planters.

It is an extremely valuable manure, although the actual amount of plant-food it contains is small. Its composition varies between wide limits and depends chiefly on the food of the animals, the nature and quality of the litter with which their dung is mixed, and the method of collection and storage.

The more nitrogenous the food, the richer is the dung in nitrogen. Stall-fed cattle, receiving rations of cake and similar feeding-stuffs produce a more valuable manure than cattle at pasture, as the following figures, obtained at Rothamstead, show :—

TABLE IV.

Nitrogen in Dung from Bullocks differently fed.

| Food. | Dry Matter in Dung. | Total Nitrogen in Dung. |
|------------------------|---------------------|-------------------------|
| Roots and hay only ... | 25.0 | 0.502 |
| Cake-fed ... | 26.5 | 0.701 |

The proportion of soluble to insoluble nitrogen is also greater in the cake-fed dung, so that its fertilising value is further increased.

The choice of material to be used as litter is somewhat restricted in Ceylon. There is not the same variety to choose from as in European countries where peat, moss, spent tan, saw-dust, and various kinds and qualities of straw can be obtained. The absorptive power of the litter is of first importance, since the liquid manure is richer in nitrogen than the solid excrement and should be preserved as completely as possible. The following Table gives the results of Breitenlohner's experiments on the absorptive power of various litters.

TABLE V.

Absorptive Power of Various Litters.

| LITTER. | Pounds of Dung-Liquor absorbed by 1,000 lbs. litter. |
|------------------------|---|
| Rye-straw | 3,000 |
| Straw of horse-beans | 3,300 |
| Sawdust | 3,571 |
| Heath (including moss) | 3,083 |
| Leaf rakings | 4,330 |
| Spent tan-bark | 2,150 |
| Fir-twigs | 250 |
| Spruce-twigs | 357 |
| Peat | 4,483 |
| Moor-earth | 550 |

Petermann's determinations are as follows :—

TABLE VI.

Absorptive Power of Various Litters.

| LITTER. | Pounds of Water absorbed by 1,000 lbs. of Litter |
|--------------|---|
| Wheat-straw | 2,540 |
| Fern-straw | 2,120 |
| Heath-straw | 1,900 |
| Genista* | 1,110 |
| Rye-straw | 3,890 |
| Fibrous peat | 8,950 |

Woolly, operating on equal volumes of litter instead of equal weights, places them in the following order :—

1. Peat
2. Loam
3. Moss, oak and beech leaves
4. Pea-straw
5. Rye-straw
6. Pine needles
7. Spruce needles
8. Quartz sand

The chief purpose of the litter being to absorb the liquid portions of the excrement, animals fed on watery foods such as roots and grass will require more bedding than those fed chiefly on cakes and concentrated foods.

* A leguminous dye-plant.

The manner in which the manure is collected and stored has a great influence on its ultimate composition. Very rapid bacterial decomposition sets in when the manure is fresh, and loss of nitrogen from this cause in the stable may amount to 20% or 30% of that voided by the animal. This loss cannot well be wholly prevented in practice but it can be minimised. The destructive fermentation of manure is promoted by aeration, and consequently is more rapid in manure which is frequently handled, and least in that which is kept undisturbed in well-compacted heaps, especially if kept moist to exclude air. Various substances have been recommended as preservatives, notably gypsum and kainit, and while both have a certain power of fixing ammonia it is found in practice that very much more than the theoretical quantities have to be used to get anything approaching complete absorption, and that the practice is not a paying one. Superphosphate would be better than either, but is again too expensive.

Peat-litter has a remarkable power of absorbing ammonia, and stables in which it is used seldom smell of the gas, but it is not readily obtainable in Ceylon.

For practical purposes the condition to aim at is the storage of the manure in well-pressed heaps kept moist. Fermentation under these conditions goes on very slowly, and in the centre of such a heap decomposition will hardly take place at all. The dung-liquor which escapes absorption by the litter should be collected, the cow-sheds being arranged so that it runs off, preferably by cemented drains, to a pit. This liquor contains all its nitrogen in a soluble form, and carries also nearly all the potash originally in the food of the animal. It ferments rapidly, however, with loss of nitrogen as ammonia.

Used by itself, dung liquor is a valuable fertiliser, particularly suited for grass. It may also be applied to other leafy crops, but not to legumes. It should not be used without dilution with water, unless possibly when applied in rainy weather.

On estates where cattle are kept it seems likely that the most efficient use that can be made of the liquid manure is for the purpose of keeping the dung-heap moist. The liquor which drains from the cattle-sheds should either be carried in pails and poured over the dung-heap, or pumped by a small hand-pump and sprayed from pipes over the heap. The drainings from this heap, diluted with 10 or 20 parts of water, should be applied to the land which carries the fodder-grasses, a small trench or hollow being scraped around each plant and the liquid run in from a watering-can.

Manure thus drenched with liquid, especially if kept in large heaps or deep pits, ferments more thoroughly and with less formation of ammonia or nitrates than that which is less thoroughly moistened.

If not infrequently smells of sulphuretted hydrogen when dug out, and this smell is an indication that fermentation losses have been reduced to a minimum.

It has been found a good plan to put down a layer of old, well-rotted manure as a foundation for the new manure heap. Fermentation losses are reduced by this means, owing probably to the evolution of carbonic acid from the old manure.

If the heap is to be left for some time without further addition, a layer of dry earth may be thrown upon it. This is merely to prevent dryage, and the manure should be well pressed down before the addition of earth.

The following (Table VII) are some typical analyses of farmyard manure.

TABLE VII.
Analyses of Farmyard Manures.

| | Dry matter. | Nitro- gen. | Phos. Acid. | Potash. |
|---|----------------|----------------|----------------|---------|
| 1. Fresh, long grass | 33.83 | 0.54 | 0.32 | 0.67 |
| 2. The same, after rotting | 24.6 | 0.80 | 0.45 | 0.49 |
| 3. Very old and short | 46.86 | 0.80 | 0.63 | 0.67 |
| 4. Rothampstead average | 24.0 | 0.64 | 0.23 | 0.32 |
| 5. Fresh cows urine | — | 1.17 | 0.02 | 1.27 |
| 6. Fresh dung liquor | 1.98 | 0.04 | 0.05 | 0.35 |
| 7. Old do | 0.87 | 0.03 | 0.01 | 0.22 |
| 8. Cow manure, free from litter | 14.70 | 0.53 | 0.16 | 0.36 |
| 9. Mixed dung and urine of cows free from litter | 16.70 | 0.41 | — | — |
| 10. Manure from milch cows | 28.31 | 0.43 | 0.30 | 0.48 |
| 11. Horse manure with litter (average) | 28.70 | 0.58 | 0.28 | 0.53 |
| 12. Sheep manure do do | 35.40 | 0.83 | 0.23 | 0.67 |
| 13. Hog manure do do | 27.60 | 0.45 | 0.19 | 0.60 |
| 14. Fresh dung from hen-yard | 44.0 | 1.60 | 1.75 | 0.85 |

NOTES:—No. 8. Cows fed on as much hay as they would eat, with additions of 4 quarts of wheat-bran and 4 quarts of mangolds per head per day.

No 10. Fed liberally on corn-meal, bran, timothy-hay and roots.

As will be seen from these analyses, if farmyard manure is valued solely on the plant-food it contains, its value is small. On this basis its value at pre-war rates would be :—

| | | | |
|----------------------------------|-------|-----|----------|
| 0.6 per cent. of nitrogen @ Rs. | 13.31 | ... | Rs. 7.99 |
| 0.3 ,, of phos. acid @ ,, | 4.00 | ... | ,, 1.20 |
| 0.5 ,, potash @ ,, | 3.70 | ... | ,, 1.85 |
| <hr/> | | | |
| Value per ton | ... | Rs. | 11.04 |
| <hr/> | | | |

Its practical value is a great deal more than this, and depends very largely on its effect in improving the condition and texture of the soil.

Manure is known as "long" when it is fresh and contains much undecomposed straw or other litter. In this condition it is liable to hot fermentation and is more suitable to heavy wet clays than to lighter soils. "Short" or well-rotted manure decomposes more slowly and is preferable for use on sandy lands and light soils generally.

Manure which has been allowed to become too dry, especially in loose heaps, undergoes quite a different form of decomposition. The process is known as *eromacausis* and is brought about chiefly by fungi and not bacteria. The heap becomes permeated by white threads of mycelium and the manure loses much of its value. It is then known as "fire-fanged." Coconut planters should note this fact, for their common practice of utilising cattle manure by tying the cattle to the trees induces this form of decomposition and is consequently wasteful. Manure for light sandy lands should be well rotted in moist heaps before use.

The weight of manure obtained from a certain head of cattle will depend, of course, on the amount of litter used. A cow will produce from 10 to 20 tons of excrement during a year, the amount of actual manure obtained from this depending on the manner in which it is collected and stored.

Similarly, the weight of manure contained in a given heap depends on its nature. It can only be determined accurately by weighing a given volume, say the contents of a box of 1 cubic foot capacity, packed to the same consistency as the manure in the heap. Roughly, a cubic foot of cow manure, thoroughly moist but not dripping wet, may be taken to weigh 60 lbs., or $3\frac{1}{2}$ tons to the cord of 128 cubic feet. If very good, a cord may weigh 4 tons. Horse manure weighs about $2\frac{1}{2}$ tons to the cord.

Horse manure is richer in fertilising ingredients than cow manure, and it decomposes more rapidly. For this reason it should not be used fresh, as its rapid fermentation causes a considerable rise in temperature, with consequent injury to roots with which it is in contact. Owing to its higher value and greater rate of wastage, more care should be taken in the collection and storage of horse-manure. From its drier nature it is more liable to "fire-fanging" and it should be mixed with moist earth or loam to retard its fermentation. In places where both cattle-manure and horse-manure are produced, the latter is best thrown upon the dung-heap and preserved in the moist, compact condition already described.

The difficulty of transport is against the use of farmyard manure on up-country estates, but its value should not be forgotten, and it will well repay application to fields in the vicinity of the yard, and will even bear the expense of transport to backward patches and quartz ridges at some distance.

CHEMICAL FERTILISERS.

The theory and application of chemical fertilisers is too wide a subject to be treated in this article, and space will not permit of more than a brief description of those in common use.

FERTILISERS COMMONLY USED IN CEYLON.

Poonacs.—Castor cake, ground nut cake, and rape cake are used.

They contain from 4 per cent. to 7 per cent. of nitrogen, together with about 1 per cent. of phosphoric acid and potash. They are valued only on their nitrogen, and are used as bulky organic fertilisers to take the place, in some measure, of farmyard manure.

Crushed Fish.—Contains from 4 per cent. to 5 per cent. of nitrogen and the same amount of phosphoric acid. It forms a valuable organic fertiliser of the same class as poonac.

Blood meal.—Contains from 12% to 13% of nitrogen, and is a useful source of this element. It decomposes rapidly in a moist warm soil.

Fish guano.—The residue after the extraction of fish oil. It is of the same nature as crushed fish, but has a higher analysis owing to the removal of the oil. It contains about 8 per cent. of both nitrogen and phosphoric acid.

Peruvian guano.—This is not much used in Ceylon owing to its high cost and the difficulty of obtaining supplies. It is a well-known organic

fertiliser, the best qualities being extremely efficient sources of nitrogen. The grades usually sold in Ceylon contain about 5% of nitrogen, 10% of phosphoric acid and 2% of potash.

Bone meal.—This is largely used, both in the steamed and unsteamed condition. The analysis of both forms is the same, namely, from 3% to 4% of nitrogen and from 20% to 22% of phosphoric acid. It is a useful source of phosphoric acid and, when steamed, is to be preferred to basic slag on light dry soils.

Sulphate of ammonia.—The most concentrated nitrogenous manure on the market, containing 20% of nitrogen. It is soluble in water but is readily fixed in soils containing clay or humus, and is seldom found in the drainage water.

Nitrate of soda.—This contains about 15% of nitrogen in the form of nitrate, and like all nitrates it acts as a plant-food without the necessity for any chemical or bacteriological change. The soda has a notable action in displacing potash from its compounds in the soil, thus behaving ultimately like a potash salt.

Nitrate of potash.—This acts similarly to nitrate of soda, but supplies potash directly instead of indirectly. Various grades are used as fertilisers, their analyses running from 10% to 12% of nitrogen and 33% to 38½% of potash.

Nitrate of lime.—Although this is not used in Ceylon at the present time it is included in this list for the sake of comparison and to prevent any confusion between it and nitrolim. It bears an exactly similar relation to nitrate of soda and nitrate of potash as these do to each other. Its nitrogen is all in the form of nitrate and immediately available. Its lime may act directly as a plant-food or indirectly as a potash fertiliser in the same way as soda. Nitrate of lime absorbs moisture very rapidly in this climate, and this has been against its use in Ceylon.

Nitrolim.—This fertiliser is quite a different substance from nitrate of lime. It is not a nitrate, and has to undergo decomposition in the soil before plants can make use of it. Its only point of similarity with nitrate of lime is its origin, both being manufactured from atmospheric nitrogen. In availability it is about equal to sulphate of ammonia.

Superphosphate.—Both ordinary and concentrated superphosphates are used. In the latter the sulphate of lime, which is formed as a by-product in making superphosphate, is removed, and the percentage of soluble phosphoric acid is thereby raised to about 42%. In ordinary superphosphate this sulphate of lime is allowed to remain, the percentage of soluble phosphoric acid being about 18%.

Basic slag.—This phosphatic fertiliser is obtained as a bye-product in the iron and steel industries, and contains the phosphoric acid originally present in the pig iron. Its analysis varies from 10% to 20% of phosphoric acid, and it contains up to about 3% of free lime. In addition to this free lime, some 20% or 30% of lime exists in easily decomposed forms and probably acts as a base in the soil.

Potash salts.—Besides nitrate of potash already mentioned, three potash salts have been in common use in Ceylon, namely, sulphate of potash, muriate of potash, and kainit. The first contain 50% and 58% of potash respectively, while kainit contains about 12%, together with some 30% of common salt.

Gypsum.—This is sulphate of lime, or calcium sulphate. It is a bye-product in many industries, and is also found in Nature. Its chief use is as an indirect potash fertiliser, having the power to displace potash from its insoluble compounds in the soil. Ordinary superphosphate has similar power, by virtue of the gypsum it contains.

The availability of different nitrogenous fertilisers has been determined by various investigators. The results must depend to some extent on soil and climatic conditions, and many organic compounds that are classes as slow-acting in temperate climates, may decompose with considerable rapidity under tropical conditions.

Wagner's results are most frequently quoted, and he has determined the relative values of nitrogenous manures as follows :—

| | | | | |
|---------------------------------------|-----|-----|-----|-----|
| Nitrate of soda | ... | ... | ... | 100 |
| Sulphate of ammonia | ... | ... | ... | 90 |
| Green crops | ... | ... | ... | 70 |
| Steamed bones, fish manure, meat meal | ... | ... | ... | 60 |
| Farmyard manure | ... | ... | ... | 45 |
| Wool dust | ... | ... | ... | 30 |
| Powdered leather | ... | ... | ... | 20 |

A more recent list places them in the following order :—

| | | | | |
|---------------------|-----|-----|-----|-----|
| Nitrate of soda | ... | ... | ... | 100 |
| Sulphate of ammonia | ... | ... | ... | 84 |
| Nitrolin | ... | ... | ... | 80 |
| Fish | ... | ... | ... | 73 |
| Meat meal | ... | ... | ... | 71 |
| Blood | ... | ... | ... | 58 |
| Horn | ... | ... | ... | 55 |
| Leather | ... | ... | ... | 15 |

The action of the several ingredients in a mixed manure is not necessarily the same, or of the same intensity, as that of each ingredient used separately. They may act chemically upon each other as well as upon the soil. For this reason, certain fertilisers should not be mixed. Chief among these incompatibles are sulphate of ammonia and lime or any substance containing lime such as basic slag or bone meal. Such mixtures lose much of their nitrogen in the form of ammonia gas, and should not be made unless they are to be used immediately. Lime, slag and bone meal also have an action on superphosphate, whereby the phosphate is rendered insoluble in water. If the action is not long continued the phosphate may remain soluble in weak acid, being then of similar availability to that in slag, but in time it reverts to a state little different from that of the phosphate rock from which it was originally derived.

GENERAL NOTES.

The following are useful tables relating to planting distances, quantity of manure per tree, etc.

In the equilateral triangular system of planting, the ground is divided into a series of equilateral triangles, the trees or bushes being placed at the corners. The number to the acre is given by the following formula :—

$$43560$$

$$\frac{\text{square of side of triangle} \times 1.155}{(\text{in feet})} = \text{Number of trees per acre.}$$

In the square system, the ground is divided into squares, and the trees placed at the corners. The number per acre is given by the formula :—

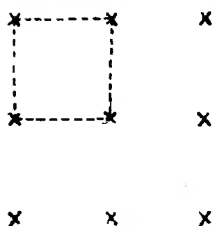
$$43560$$

$$\frac{\text{square of planting distance}}{(\text{in feet})} = \text{Number of trees per acre.}$$

The 'triangular' system has many adherents in India. It is claimed that as opposed to 'square' planting, it economises space without overcrowding the plants.

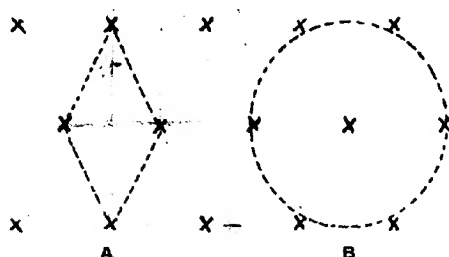
In triangular planting each bush is placed in the most advantageous position possible, with regard to adjacent bushes, for equal root development all round.

A comparison between the square and triangular systems is given below:—



Square Planting.

[By joining four adjacent bushes a square is formed.]



Triangular Planting.

[By joining four adjacent bushes a rhombus is formed; *i.e.*, two equilateral triangles (A). Each bush forms the centre of a circle of equidistant bushes (B).]

In the "quincunx" method the trees are planted as in the square method, with the addition of one tree in the centre of each square. The number of trees per acre cannot be calculated by any simple formula: it depends on the number of rows in either direction. It has been erroneously stated that the quincunx system requires 15 per cent. more trees than the square system for the same planting distance. This is very much below the mark.

An approximate number can be obtained by considering the area occupied by 4 trees planted square. The additional trees allotted to this area on the quincunx system are one in the centre and four half-trees on the boundary lines. That is, the number of extra trees is 3 for every four, or 75 per cent.

In practice the number varies according to the number of boundary trees, *i.e.*, according to the shape of the ground. The more nearly square the acreage, the greater the number of extra trees required, and the narrower the acreage in proportion to its length, the less the number required. Thus, suppose the number of trees per acre be 108 ($20' \times 20'$), planted in 10 rows of 10 trees each and 1 row of 8 trees, then in the 10 rows of 10 trees there will be 9 rows of 9 spaces or 81 spaces, and there will also be 7 spaces in the row of 8 trees. There will thus be a total of 88 spaces, in each of which a tree would be placed. The quincunx system in this case, therefore, requires 88 extra trees in 108, or 81.6 per cent. Again, take the limiting case in the opposite direction, where

the 108 trees are planted in 2 rows of 54 trees each. This will give 53 spaces, or 49 per cent. extra trees. Any variation between these two is possible according to the shape of the ground.

A common method of planting is the rectangular. This is the same as the square method, except that the distances are not the same in both directions. To find the number of trees per acre divide 240 by one of the planting distances (in feet) and $18\frac{1}{2}$ by the other, then multiply the two results together.

The following tables give the number of plants per acre on the triangular and on the square or rectangular systems for various common planting distances.

TABLE VIII. Equilateral Triangular System.

| Distance (Feet) | Plants per Acre. |
|--------------------|---------------------|
| 1 x 1 | 50,311 |
| 2 x 2 | 12,577 |
| 3 x 3 | 5,590 |
| 4 x 4 | 3,144 |
| 5 x 5 | 2,012 |
| 6 x 6 | 1,397 |
| 7 x 7 | 1,025 |
| 8 x 8 | 785 |
| 9 x 9 | 621 |
| 10 x 10 | 502 |
| 11 x 11 | 415 |
| 12 x 12 | 348 |
| 13 x 13 | 296 |
| 14 x 14 | 256 |
| 15 x 15 | 222 |
| 16 x 16 | 196 |
| 17 x 17 | 173 |
| 18 x 18 | 154 |
| 19 x 19 | 138 |
| 20 x 20 | 125 |
| 21 x 21 | 114 |
| 22 x 22 | 103 |
| 23 x 23 | 94 |
| 24 x 24 | 86 |
| 25 x 25 | 79 |
| 30 x 30 | 55 |
| 35 x 35 | 40 |
| 40 x 40 | 31 |

Table IX. Square and Rectangular Systems.

| Dis- tance (in- ches.) | Plants per acre. | Dis- tance (feet.) | Plants per acre. | Dis- tance (feet.) | Plants per acre. | Dis- tance (feet.) | Plants per acre. | Dis- tance (feet.) | Plants per acre. |
|---------------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| 1 x 1 | 6272640 | 1 x 1 | 43560 | 3½ x 4 | 3111 | 9 x 11 | 440 | 22 x 22 | 90 |
| 1 x 2 | 3136320 | 1 x 1½ | 29040 | 3½ x 4½ | 2766 | 9 x 12 | 403 | 23 x 23 | 82 |
| 1 x 3 | 2090880 | 1 x 2 | 21780 | 3½ x 5 | 2489 | 10 x 10 | 435 | 24 x 24 | 75 |
| 1 x 4 | 1568160 | 1 x 2½ | 17424 | 4 x 4 | 2722 | 10 x 12 | 363 | 24 x 30 | 60 |
| 1 x 5 | 1254528 | 1 x 3 | 14520 | 4 x 4½ | 2420 | 10 x 15 | 290 | 25 x 25 | 70 |
| 2 x 2 | 1568160 | 1 x 3½ | 12446 | 4 x 5 | 2178 | 10 x 18 | 242 | 25 x 30 | 58 |
| 2 x 3 | 1045440 | 1 x 4 | 10890 | 4 x 5½ | 1980 | 10 x 20 | 217 | 30 x 30 | 48 |
| 2 x 4 | 784080 | 1 x 4½ | 9679 | 4 x 6 | 1815 | 10 x 25 | 174 | 30 x 35 | 41 |
| 2 x 5 | 627264 | 1 x 5 | 8712 | 4½ x 7 | 1556 | 10 x 30 | 145 | 30 x 36 | 40 |
| 3 x 3 | 696960 | 1 x 5½ | 7920 | 4½ x 5 | 1936 | 11 x 11 | 360 | 30 x 40 | 36 |
| 3 x 4 | 522720 | 1 x 6 | 7260 | 5 x 5 | 1742 | 12 x 12 | 302 | 33 x 33 | 40 |
| 3 x 5 | 418176 | 1½ x 1½ | 27878 | 5 x 5½ | 1584 | 12 x 15 | 242 | 35 x 35 | 35 |
| 3 x 6 | 348480 | 1½ x 2½ | 13939 | 5 x 6 | 1452 | 12 x 18 | 201 | 35 x 40 | 31 |
| 4 x 4 | 392040 | 1½ x 3 | 11616 | 5 x 7 | 1244 | 12 x 20 | 181 | 36 x 36 | 33 |
| 4 x 5 | 313632 | 1½ x 3 | 9680 | 5 x 8 | 1089 | 12 x 24 | 151 | 36 x 40 | 30 |
| 4 x 6 | 261360 | 1½ x 4 | 7260 | 5 x 9 | 968 | 12 x 30 | 121 | 40 x 40 | 27 |
| 5 x 5 | 250905 | 2 x 2 | 10890 | 5 x 10 | 871 | 13 x 13 | 257 | | |
| 5 x 6 | 209088 | 2 x 2½ | 8712 | 6 x 6 | 1210 | 14 x 14 | 222 | | |
| 6 x 6 | 174240 | 2 x 3 | 7260 | 6 x 7 | 1037 | 15 x 15 | 193 | | |
| 6 x 9 | 116160 | 2 x 3½ | 6218 | 6 x 8 | 906 | 15 x 18 | 161 | | |
| 6 x 12 | 87120 | 2 x 4 | 5445 | 6 x 9 | 806 | 15 x 20 | 145 | | |
| 7 x 7 | 128013 | 2 x 4½ | 4840 | 6 x 10 | 726 | 15 x 30 | 96 | | |
| 8 x 8 | 98010 | 2 x 5 | 4356 | 6 x 12 | 605 | 16 x 16 | 170 | | |
| 8 x 10 | 78408 | 2 x 5½ | 3960 | 7 x 7 | 888 | 17 x 17 | 160 | | |
| 8 x 12 | 65340 | 2 x 6 | 3630 | 7 x 8 | 777 | 18 x 18 | 134 | | |
| 9 x 9 | 77440 | 3 x 3 | 4840 | 7 x 9 | 691 | 18 x 20 | 121 | | |
| 10 x 10 | 62726 | 3 x 3½ | 4150 | 7 x 10 | 622 | 18 x 24 | 100 | | |
| 10 x 12 | 52272 | 3 x 4 | 3630 | 8 x 8 | 680 | 18 x 30 | 80 | | |
| 10 x 20 | 31363 | 3 x 4½ | 3228 | 8 x 9 | 605 | 19 x 19 | 120 | | |
| 10 x 24 | 26136 | 3 x 5 | 2904 | 8 x 10 | 544 | 20 x 20 | 108 | | |
| 10 x 30 | 20908 | 3 x 5½ | 2640 | 8 x 11 | 495 | 20 x 24 | 90 | | |
| 10 x 36 | 16424 | 3 x 6 | 2420 | 8 x 12 | 453 | 20 x 25 | 87 | | |
| 10 x 48 | 13068 | 3 x 7 | 2074 | 9 x 9 | 537 | 20 x 30 | 72 | | |
| 11 x 11 | 51840 | 3½ x 3½ | 3556 | 9 x 10 | 484 | 21 x 21 | 99 | | |

Table X.—Quantity of Manure to apply per Tea Bush.

| lbs. manure per acre. | QUANTITY IN OUNCES PER BUSH, PLANTED. | | | | | | | | | | | |
|--------------------------|---------------------------------------|-------|--------|-------|---------|--------|---------|-------|--------|-------|---------|-------|
| | 3 × 3 | 3 × 4 | 3 × 4½ | 3 × 5 | 3½ × 3½ | 3½ × 4 | 3½ × 4½ | 4 × 4 | 4 × 4½ | 4 × 5 | 4½ × 4½ | 5 × 5 |
| 250 | 0.83 | 1.10 | 1.24 | 1.38 | 1.12 | 1.28 | 1.44 | 1.48 | 1.65 | 1.84 | 1.86 | 2.29 |
| 300 | 1.00 | 1.32 | 1.48 | 1.65 | 1.35 | 1.55 | 1.71 | 1.78 | 1.99 | 2.23 | 2.25 | 2.78 |
| 350 | 1.15 | 1.54 | 1.74 | 1.93 | 1.58 | 1.80 | 2.02 | 2.07 | 2.31 | 2.57 | 2.60 | 3.21 |
| 400 | 1.32 | 1.76 | 1.98 | 2.20 | 1.80 | 2.06 | 2.31 | 2.35 | 2.64 | 2.94 | 2.98 | 3.67 |
| 450 | 1.49 | 1.98 | 2.24 | 2.48 | 2.02 | 2.31 | 2.60 | 2.65 | 2.97 | 3.31 | 3.35 | 4.13 |
| 500 | 1.65 | 2.20 | 2.48 | 2.75 | 2.25 | 2.57 | 2.89 | 2.94 | 3.30 | 3.68 | 3.72 | 4.59 |
| 550 | 1.82 | 2.42 | 2.73 | 3.03 | 2.48 | 2.83 | 3.18 | 3.23 | 3.63 | 4.04 | 4.10 | 5.05 |
| 600 | 1.98 | 2.64 | 2.98 | 3.31 | 2.70 | 3.08 | 3.47 | 3.52 | 3.97 | 4.41 | 4.47 | 5.51 |
| 650 | 2.15 | 2.86 | 3.23 | 3.58 | 2.93 | 3.34 | 3.76 | 3.82 | 4.30 | 4.78 | 4.84 | 5.97 |
| 700 | 2.31 | 3.08 | 3.48 | 3.86 | 3.15 | 3.60 | 4.05 | 4.11 | 4.63 | 5.15 | 5.21 | 6.43 |
| 750 | 2.49 | 3.31 | 3.73 | 4.13 | 3.37 | 3.86 | 4.33 | 4.41 | 4.96 | 5.51 | 5.59 | 6.89 |
| 800 | 2.65 | 3.53 | 3.98 | 4.41 | 3.60 | 4.11 | 4.62 | 4.70 | 5.29 | 5.88 | 5.96 | 7.35 |
| 850 | 2.81 | 3.75 | 4.22 | 4.68 | 3.82 | 4.37 | 4.91 | 5.00 | 5.62 | 6.29 | 6.33 | 7.81 |
| 900 | 2.98 | 3.97 | 4.47 | 4.96 | 4.05 | 4.63 | 5.21 | 5.29 | 5.95 | 6.62 | 6.70 | 8.27 |
| 950 | 3.14 | 4.19 | 4.72 | 5.23 | 4.27 | 4.88 | 5.50 | 5.59 | 6.28 | 6.98 | 7.08 | 8.73 |
| 1000 | 3.31 | 4.41 | 4.97 | 5.51 | 4.50 | 5.14 | 5.78 | 5.88 | 6.61 | 7.35 | 7.45 | 9.19 |

The following are suitable distances for planting fruit trees, etc. :—

| | Distance in feet (each way). | Number per acre on square system. |
|-------------------------|---------------------------------|--------------------------------------|
| Almond ... | 20 to 30 | 108 to 48 |
| Banana (small kind) ... | 12 „ 16 | 302 „ 170 |
| „ (large kind) ... | 20 „ 25 | 108 „ 69 |
| Fig ... | 25 „ 30 | 69 „ 48 |
| Lemon ... | 26 „ | 108 „ |
| Mango ... | 30 „ 40 | 48 „ 27 |
| Mulberry ... | 20 „ 25 | 108 „ 69 |
| Orange ... | 20 „ 30 | 108 „ 48 |
| Peach ... | 20 „ 22 | 108 „ 90 |
| Persimmon ... | 15 „ 20 | 193 „ 108 |
| Plum ... | 18 „ 20 | 134 „ 108 |

| | Distance between Plants (feet). | Distance between rows (feet). |
|--------------------|------------------------------------|----------------------------------|
| Grapes (table) ... | 8 to 12 | 6 to 12 |
| Passion Fruit ... | 6 „ 8 | 10 „ |
| Pineapples ... | 1½ „ 2 | 3 „ 4 |
| Strawberries... .. | 1 „ 1½ | 3 „ 4 |
| Water-melons ... | 8 | — |

Rail-freight on Manures.

Manures are carried by the Ceylon Government Railway at 6th Class rates, provided the quantity be 4 tons or over. Lots of less than 4 tons are charged at either 4th Class or 6th Class rates, according to which is cheaper.

MEDICAL INFORMATION.

ANCHYLOSTOMIASIS.

SYNONYMS: Hookworm Disease; Uncinariasis; Anaemia of Ceylon, etc.

Hookworm disease has, no doubt, existed for centuries past. The first cases described, that seem more or less authentic, date back to the early part of the seventeenth century when Piso, in Brazil, reported a group of symptoms which, in the light of present knowledge, were presumably due to hookworm infection, though the worm itself was not demonstrated. It is only within recent years that the group of symptoms characteristic of the disease have been ascribed to the true cause—the presence of hookworms in the intestinal canal.

Two distinct varieties of the worm are recognized, viz., the *Anchylostomum duodenale*, or Old World form, and the *Necator Americanus*, or New World species. Both varieties are found in Ceylon. The worms are, roughly, $\frac{1}{3}$ to $\frac{3}{4}$ th inch in length, but little larger than ordinary sewing cotton in diameter, and are yellowish-white or white in colour.

The female worm lays her eggs in the intestinal canal of the human host, after which they are passed in the excrement, which, unfortunately, is too often deposited on the ground where, provided favourable conditions such as moisture, shade and warmth prevail, the eggs hatch in from 8 to 48 hours. After a period of 2 to 5 days the young worms reach the infective stage, and are ready to enter the body, and which they accomplish through the skin or mouth, in the latter instance usually through the medium of food or drink. In the great majority of instances they enter through the skin and more frequently through the feet and ankles as these parts are, ordinarily, more exposed to a ground infection. Many embryos (young worms) may enter through unbroken, healthy skin at one time. In case entrance to the body is effected in this manner, they enter the blood vessels, and are carried with the blood-stream to the heart, thence to the lungs where they find their way into the bronchial tubes and from there into the mouth where they are very often swallowed. They pass through the stomach into the intestinal canal, where they attach themselves to the small intestine by drawing

a portion of the lining membrane into the mouth, and, by so doing, provide themselves with a source of nourishment, as they feed on blood drawn from the intestinal walls. In case the infection takes place through the mouth, the young worms pass directly into the intestinal canal. The eggs do not hatch in the body. Neither the hookworm eggs nor the young worms are visible to the eye without the aid of a strong lens or microscope.

The worms reach the adult stage, and the females, which comprise about two-thirds of the total number, begin to lay eggs in from 6 to 8 weeks after infection has taken place. Each female worm is capable of laying something like 2,000 eggs per day, and as more than 5,000 worms have been recovered, after treatment, from one person, it is apparent that the number of eggs passed daily in the excrement of a heavily infected person may exceed five millions. Assuming, by way of illustration, that only ten per cent. of these eggs hatch, it is evident that a person with even a mild degree of infection is a distinct menace to the health of the public, in that such a person is liable to spread the disease. According to prominent authorities, the individual hookworm will, unless eliminated by medication, live in the human host for a period of 8 to 10 years, after which it dies of old age, hence, in case no re-infection occurs, it is possible to recover from an infection without treatment. It is, however, extremely inadvisable to trust to recovery in this manner, as permanent bodily injury is apt to take place in the meantime, and the person is a constant menace to the health of others.

The lower animals are subject to the disease, but, so far as is known, they suffer from species of the worm peculiar to them; the species of the worm peculiar to man will not, it seems, infect animals or *vice versa*.

Symptoms.—Dock and Bass, in their book on hookworm disease, describe the classes of cases very clearly under three headings, which they quote from the writings of Ashford and King, viz., "Slight," "Moderate," and "Marked cases." This classification is followed below, and the symptoms enumerated are, in part, those cited by the abovenamed writers.

Slight Cases.—It must be remembered that a fairly large percentage of this class of cases present no noticeable symptoms, but are, nevertheless, a distinct menace to the health of the public, on account of the fact that they pass thousands of hookworm eggs with each action of the bowels, and are thus liable to be instrumental in spreading the disease, unless the excrement is properly disposed of.

One of the first symptoms noted is the familiar "ground itch," which is complained of in the early stage of many infections; this troublesome affliction is caused by the young worms passing through the

skin. The "itch" is caused partly by the irritation of the worms passing through the skin, and it is believed that they deposit an irritant substance in the skin at the same time. When you see a person suffering from a true ground itch, you may be sure that person will, in about 6 weeks, show the presence of hookworm eggs in the excrement. These cases, as a rule, present slight paleness, and the amount of perspiration is diminished. The appetite is variable, attacks of distress or pain in the stomach often occur, and gas in the stomach and abdomen is frequently troublesome. There is a tendency to shortness of breath on slight exertion, and occasionally palpitation of the heart is experienced. The mental faculties are dulled; dizziness, headache, and disinclination to work are experienced. The amount of hæmoglobin (red colouring matter of the blood) is normally about 90 per cent; in this class of cases it will be found to average something like 60 per cent., which indicates that the worms have extracted a considerable amount of blood from the circulation. As already stated, this is the way they obtain their nourishment. The extraction of the red corpuscles from the blood causes the familiar paleness or anemia seen in hookworm disease, and leads to other distressing symptoms.

Moderate Cases.—This is the class of cases that predominate in Ceylon, as elsewhere. Here all of the above symptoms are exaggerated. Pallor is more marked, sweating is greatly diminished, nausea and vomiting are often experienced, and the tongue is seen to be coated and is often large and flabby. Breathlessness and palpitation of the heart are more marked, and the patient becomes exhausted on slight exertion. There is a tendency to frequent headaches, pain in the chest, and noises or ringing in the ears. Weakness of the knees and legs is often troublesome and the person becomes quite stupid at times. Joint pains are so common that a diagnosis of rheumatism is often made. In this stage the hæmoglobin ranges from 30 to 60 per cent.

Marked Cases.—When this stage is reached the patient may, at any time, succumb to the disease. Pallor is extreme, the appetite may be absent or ravenous, nausea and vomiting frequently occur, and diarrhoea is often a distressing symptom. Decided shortness of breath occurs upon the slightest physical effort; dropsy of the feet, ankles, and frequently of the legs, body and abdomen is seen. Everyone is familiar with the so-called "dirt eaters." Dirt eating is another manifestation of hookworm disease, and may be present even in the earlier stages of the disease; there is a strong desire to eat earth, ashes, hair, lime, chalk, feathers and other indigestible substances. If you know a person who is addicted to this habit, you may be fairly certain that hookworm disease is the cause of it. In this stage of the

disease many of the large, unsightly ulcers, so often seen in Ceylon, are found; they are usually associated with a marked degree of debility and anemia, and are very difficult to cure unless the hookworms are removed from the body. After the patient has been cured of hookworm disease many of them will, as the person becomes stronger, disappear without treatment; this is due to the fact that the drain of blood from the system has been stopped and the body is given an opportunity to recuperate. Dizziness and ringing in the ears are very common, the facial expression is anxious; even melancholic, the intellect is dulled, mental processes are slow, and the patient is very stupid. Extreme weakness is experienced, and irregular fever may be noted with, at times, a subnormal temperature. The percentage of hæmoglobin may be as low as 5 and ranges from that figure to 30. When the above picture presents itself the patient is, unless prompt and efficient treatment is instituted, almost certain to die; even with the best of care and treatment a certain percentage of these advanced cases cannot be cured. Death under these conditions should not be attributed to the treatment, as it was, in the absence of treatment, certain.

No person is immune from hookworm disease; the reason that one race or nationality is more heavily infected than another is that, by reason of habit or environment, it is more exposed to infection. Persons living in cold climates are not immune from the ravages of the disease, but rarely contract it, on account of the fact that, as the eggs hatch in the earth only in the presence of warmth, shade, and moisture, it is essentially a disease of warm climates. What is known as the "Hookworm Belt" encircles the globe between about 36 degrees north and 30 degrees south of the Equator, which, of course, corresponds to the part of the world that affords the proper climatic conditions, continual warmth and moisture, for the propagation of the disease. The assertion is made that more persons are afflicted with hookworm disease than with any other disease, and this seems plausible when it is realized that something like seven hundred millions of persons are sufferers from hookworm infection. The outlook for tropical countries in this connection would be dismal, indeed, were it not for the fact that science has revealed the secrets of the disease, with the result that it can be quite readily prevented, and easily cured.

The degree of infection found among the villagers examined in Aluwatagoda and Wilane, in the Kandy district, was 97.5 per cent., while the estate labourers examined in the Matale district presented an infection of 96 to 99 per cent. In view of what has already been said, it will be quite evident that the disease presents one of the greatest and most im-

portant economic problems that confront Ceylon today, for the results of examinations made up to the present seem to indicate that possibly 90 per cent., or more, of the entire population of Ceylon may be found to be infected, hence, in view of the fact that two of the most prominent manifestations of the disease are a reduction of physical strength and a dulling of the mental faculties, it is not reasonable to expect the normal amount of mental or physical effort from the people as a whole or from those even moderately infected. If a child becomes infected early in life, his teacher at school regards him as being lazy or stupid; after he leaves school and tries to make his own way in the world, the same estimate of his capabilities follows him; such a person is never able to exercise to the maximum his latent power, as he would have done had he not been handicapped by disease.

The wonderful improvement in the physical condition of many of those cured in the course of the present campaign against the disease in the Kandy and Matale districts is sufficient evidence of the efficacy of the treatment. Many who would, if untreated, have died within a comparatively short space of time, have been treated and cured, with the result that they have recovered their health and strength and are again able to assume the duties of citizenship. The Superintendent of one of the estates on which the coolies had been treated stated that his turn-out of labour on one division had increased from 66 per cent. before treatment to 92 and 94 per cent. within 4 months of the time that treatment was commenced; this is surely conclusive evidence of the benefits to be derived from treatment. Many persons have walked distances of one to more than sixty miles in order to secure treatment.

Treatment.—The treatment of the disease can well be considered under two heads, viz.: "Preventive Measures" and "Curative Measures," of which the former are by far the more important in connection with the permanent eradication of the disease and will, therefore, be considered first.

Preventive Measures.—The Universal Installation and use of the proper type of Privy or Latrine is the most Essential Measure in the Ultimate Eradication of Hookworm Disease from Ceylon.—It has been stated above that the eggs of the worm will not hatch within the human host, but require to be deposited on moist, warm earth or other suitable medium; climatic conditions in Ceylon, and the habit of depositing the excrement on the ground are, therefore, most favourable to the spread of the disease. If all excrement is deposited in suitable privies or latrines of the pit type, the eggs will either not hatch, or if they do, the young worms will not be able to reach the surface of the ground; if the bucket type of privy or latrine is utilized the bucket contents should be disposed of by burying

in a deep pit or trench, or, what is even more desirable, by burning in an incinerator which can be constructed at moderate expense. After the hookworm embryo has reached the infective stage, 2 to 5 days after hatching, it will, under favourable conditions, remain quiescent in the earth for a period of 6 to 10 months, unless it has an opportunity to enter the body either through the skin or mouth; in the former instance it is not necessary that a break in the skin be present, for the young worm can, and usually does, enter through the healthy skin. It is readily apparent, therefore, that the greatest factor in the prevention of the disease is the disposal of all human excrement in such a manner that it will not be deposited on the surface of the ground. This can be accomplished only by the Use of proper privies or latrines.

If every Person in Ceylon would deposit the Excrement in the right type of Privy or Latrine, Hookworm Disease would soon cease to be an Economic Factor, and the Incidence of such Diseases as Enteric Fever, Diarrhoeas, Dysentery, and other Intestinal Diseases would be greatly diminished.

The Government of Ceylon is carrying on a campaign of education along sanitary lines in connection with the Anchylostomiasis Campaigns, and it is understood that either the Principal Civil Medical Officer, the Senior Sanitary Officer, or the Sanitary Medical Officer assisting in the campaign at Matule will be very glad to give advice and instruction to those who may desire to do their share in the eradication of this scourge from Ceylon.

Other preventive measures consist of thoroughly washing the hands before eating or handling food, and in insisting that all servants do likewise. Do Not eat uncooked salads or foods that may have been grown in the presence of infected excrement, either used as manure or washed into the ground by rain or otherwise. It is as important that the hands of domestic servants shall be free from infection as it is that only food-stuffs uncontaminated by excrement shall be eaten. For example, food may be properly prepared and thoroughly cooked, but is allowed to cool before being served; in the meantime one of the servants, who may have been careless and not thoroughly washed or disinfected his hands after handling infected earth or other filth, takes up this food and inadvertently or purposely touches some part of it, with the result that it becomes as dangerous as if it had not been cooked. Then again it is important to make certain that the water supply is above suspicion, for, although hookworm infection by means of drinking water is comparatively infrequent, it may occur. The provisions of this paragraph apply even more strongly to the incidence of the majority of other intestinal diseases.

Curative Measures.—A brief outline of the methods employed in the Anchylostomiasis Campaigns may be of interest. A number of dispensers are employed, whose duty it is to first compile a list of all the persons in their respective districts, in order that an accurate record may be kept of the treatments administered to each person; they then provide each person with a $\frac{1}{2}$ oz. tin container, with the name, age, sex, etc., written on a paper slip inserted in the cover, and request that a portion of the excrement be placed in it. The next morning these tins are collected and sent to the central laboratory where a staff of microscopists is maintained to examine the specimens under the microscope; a portion of the specimen is placed on a glass slide, mixed with water and a search made for the eggs of the hookworm and other worms as well. In case a specimen is found negative after a careful examination, it is then centrifuged and it has been found that about 20 per cent. of the cases found negative on first examination are then found positive; these are the lightly infected cases. A list of the positive specimens is then returned to the dispenser in the field who enters the names in his treatment book and proceeds, after a medical examination has been made, to treat them until cured. To assist in locating patients, each house is given a number which is placed on a prominent place with red chalk.

Oil of *Chenopodium* and Thymol are the two drugs used in the campaigns; they are probably about equally valuable in the treatment of hookworm disease; though recent results seem to indicate that *chenopodium* is the more efficacious drug of the two, and is also almost a specific in the removal of the common round worms and a valuable remedy in the eradication of the other intestinal worms commonly found in Ceylon. More than half of the people examined have been found to harbour round worms, and as many as 120 of them have been recovered after one treatment with *chenopodium*. It has been ascertained that many people are infected with hookworms, round, whip and thread worms; at rare intervals the eggs of a tape worm are found. *Strongyloides* are quite often found.

The actual treatment of the disease should be carried out only under medical direction, and by persons trained specially for this work.

Many of the more severe cases will require medication to assist in restoring them to health after they have been cured of their infection. A good combination for this purpose is as follows:—

| | Grain. | | Grain. |
|------------------|--------|--------------------|--------------------|
| Reduced iron | ... 1 | Aloin | ... $\frac{1}{4}$ |
| Quinine sulphate | ... 1 | Strychnia sulphate | ... $\frac{1}{30}$ |
| Gentian | ... 1 | Arsenious acid | ... $\frac{1}{60}$ |

The above ingredients should be put up in the form of tabloids. One tabloid may be given three times daily, after meals. In case of diarrhoea resulting from administration in this dosage, give only one to two daily. For cases between the ages of 5 and 16 years, tabloids containing one-half of each of the above drugs may be administered. Many of the leg ulcers, which are so common, will disappear after the person has been cured of hookworm infection. Ulcers which persist may be stimulated with tincture of iodine, subnitrate of bismuth, stearate of zinc, &c. In case granulation tissue is too prominent to be removed with the above drugs, it may be necessary to cauterize with silver nitrate, after which a suitable dusting powder should be used. The ulcers should be dressed daily, and subsequently the leg should be bound firmly with a bandage. If possible, the whole of this treatment should be carried out under medical supervision.

SUMMARY.

How can **You** assist in eradicating hookworm disease from Ceylon

1. By building and using a proper type of latrine or privy and by influencing all of your friends to do the same.
2. By being examined, and, if found infected, by accepting treatment until cured, and by using your influence to persuade others to do likewise.
3. By telling those who are not familiar with the disease about the effects produced as result of infection, and the ease with which they may be cured.
4. By instructing servants in the proper methods of personal and domestic cleanliness and sanitation.
5. By using boiled water for domestic purposes, unless you are able to secure water from a city or other system which is known to be pure.
6. By looking upon and acting toward the person who deposits the excrement on the ground as a menace to your health and to that of your friends.

Let every person start a campaign of education, and action, along these lines and, when the disease is eliminated as an economic factor, the Island and people of Ceylon will be greatly enriched thereby.

JOHN E. SNODGRASS,
Director, Anchylostomiasis Campaign,
Ceylon.

**A.—THE FOLLOWING ARE THE REGULATIONS FOR THE ISSUE OF
MEDICINES TO SUPERINTENDENTS, &c., FOR THE USE OF LABOURERS,
FROM GOVERNMENT OUTDOOR DISPENSARIES AND HOSPITALS.**

I.—Medicines in Bulk *not exceeding* in value Rs. 5-00 will be issued at the Government Outdoor Dispensary at prime cost for credit, but only those mentioned in Appendices A. and B. below.

II.—Medicines in bulk exceeding Rs. 5-00 in value may be obtained from the Civil Medical Stores, Colombo. The Requisition Form Medical 159 ("Estate Requisition for Medicines") should be sent to the Hon'ble Principal Civil Medical Officer, Colombo, accompanied by a cheque or money order for the cost of the drugs, with full directions how they are to be forwarded.

A separate requisition should be sent for Sulphate of Quinine and a separate one for Laudanum.

III.—No medicines will be issued in bulk from the Government Outdoor Dispensary except upon a written order signed by the Superintendent of the estate *certifying* that they are required for the use of the labourers on that estate on the authorized form (Medical No. 200). A book of such forms will be supplied by the D. M. O. on application to him for same.

IV.—Prescriptions ordered for Proprietors, Superintendents or Assistant Superintendents or Conductors, &c., may be compounded and issued for cash at the following rates, but only when such patients have no opportunity of having them dispensed elsewhere :—

| | | | |
|---------------------------------|----------|---------------------------|---------|
| Mixtures and Draughts, per oz. | 5 cts. | Ointments, per oz. | 10 cts. |
| Lotions, Injections, Gargles, „ | 2 „ | Liniments, per oz. | 10 „ |
| Pills and Powders | each 2 „ | Blisters, per square inch | 2 „ |

APPENDIX B.

| | |
|--------------------------|-----------------------------|
| Alum Gargle. | Rheumatic Mixture. |
| Black Wash. | Stimulant Mixture. |
| Blue Stone Lotion. | Tonic Mixture. |
| Carbolic Lotion. | White Mixture. |
| Carbolic Oil. | Astringent Powders (adults) |
| Eye Wash (Boric or Zinc) | „ „ for children |
| Astringent Mixture. | Fever Powders No. 149. |
| Cough Mixture. | Purgative Powders. |
| Fever Mixture. | Astringent Pills. |

| | Rs. cts. | |
|---|----------|---------|
| Acacia Gum Pulv. | 25 | per oz. |
| Acid Acetic | 10 | " " |
| " Boric | 10 | " " |
| " Carbolic | 40 | " " |
| " Hydrochloric | 20 | " " |
| " Nitric | 20 | " " |
| " Sulphuric | 20 | " " |
| Alum Pulv. | 20 | " " |
| Ammon Carbon | 20 | " " |
| Argenti Nitras | 3 00 | " " |
| Borax Pulv. | 10 | " " |
| Bismuthi Subnitrates | 1 00 | " " |
| Caffeine Citrate | 1 75 | " " |
| Camphor | 20 | " " |
| Chlorodyne | 30 | " " |
| Cholera Mist. with Opio | 10 | " " |
| Cinchona Cortex | 50 | " lb. |
| Condy's Fluid | 05 | " oz. |
| Copaiba | 40 | " " |
| Creasotum | 2 00 | " " |
| Creta Ppt. | 05 | " " |
| Cupri Sulph | 10 | " " |
| Emplaster. Cantharid | 1 00 | " " |
| " Resini | 15 | " " |
| Extr. Belladonna Viride | 1 00 | " " |
| " Ergot. Liquid | 50 | " " |
| " Filicis Liquid | 60 | " " |
| Ferri Carb. Sach. Tabloids (5 gr.) | 20 | " " |
| " Sulph. | 15 | " " |
| Hydrarg. cum. Urete | 35 | " " |
| " Subchloride | 60 | " " |
| Iodoform and Boric Acid Powder | 25 | " " |
| Ipecac. Pulv. | 1 75 | " " |
| Jalap Pulv. | 30 | " " |
| Linimentum Saponis | 1 00 | " lb. |
| Liq. Ammon. Fort | 25 | " oz. |
| " " Acet. Fort | 20 | " " |
| " Arsenicalis | 10 | " " |
| " Potass | 10 | " " |
| " Strychnine Hydrochloride | 20 | " " |
| Magnes. Carb. | 15 | " " |

| | Rs. cts. |
|---------------------------|------------|
| Magnes. Sulphas ... | 20 per lb. |
| Napthol Beta Tabloids ... | 75 „ oz. |
| Oleum Chenopodium... | 1 80 „ „ |
| „ Eucalyptus ... | 30 „ „ |
| „ Ment. Pip. ... | 1 00 „ „ |
| „ Resinæ ... | 1 00 „ lb. |
| „ Terebinth ... | 60 „ „ |
| Phenacetin ... | 5 00 „ oz. |
| Pil. Colocynth Co. ... | 80 „ „ |
| „ Hydrargyri ... | 40 „ „ |
| „ Rhei Co. ... | 40 „ „ |
| Plumbi Acetas ... | 10 „ „ |
| Potass Bicarb Pulv... | 25 „ „ |
| „ Bromid ... | 50 „ „ |
| „ Iodid ... | 1 50 „ „ |
| „ Nitras ... | 50 „ „ |
| „ Tart Acid Pulv. | 25 „ „ |
| Pulv. Cret. Aromat ... | 25 „ „ |
| „ Ipecac. Co. ... | 75 „ „ |
| Quinine Sulphas ... | 2 00 „ „ |
| Rhei Pulv. ... | 40 „ „ |
| Salol ... | 4 00 „ „ |
| Santonin ... | 10 00 „ „ |
| Senna Folia ... | 25 „ lb. |
| Sodii Bicarb ... | 10 „ oz. |
| „ Salicylas ... | 75 „ „ |
| Spirit Aetheris ... | 25 „ „ |
| „ Ammon. Aromat ... | 15 „ „ |
| „ Aetheris Nitrosi ... | 15 „ „ |
| Sulphur Sublimate ... | 06 „ „ |
| Tinct. Belladonnae ... | 25 „ „ |
| „ Benzoin Co. ... | 20 „ „ |
| „ Camphor Co. ... | 15 „ „ |
| „ Catechu ... | 15 „ „ |
| „ Digitalis ... | 15 „ „ |
| „ Ferri Perchloride ... | 10 „ „ |
| „ Hyoscyami ... | 25 „ „ |
| „ Iodine ... | 25 „ „ |
| „ Nucis Vomica ... | 15 „ „ |
| „ Scillæ ... | 15 „ „ |
| „ Zingiberia ... | 15 „ „ |

| | Rs | cts. | |
|-------------------------------|------|---------|--|
| Ung. Calamina | 20 | per oz. | |
| „ Hydrarg Nitras | 20 | „ „ | |
| „ Paraffin | 15 | „ „ | |
| „ Resinae | 15 | „ „ | |
| „ Sulph. Co. | 15 | „ „ | |
| Vin. Ipecac. | 30 | „ „ | |
| Zinci Oxide | 15 | „ „ | |
| „ Sulph. | 10 | „ „ | |
| Zingiber Pulv. | 20 | „ „ | |
| Bandages, Cotton | 12 | each. | |
| Lint, Hospital | 1 50 | per lb. | |
| Tow | 1 00 | „ „ | |
| Cotton Wool, Absorbent | 1 25 | „ „ | |

These prices are prevalent now but are apt to fluctuate with war conditions.

[Extract from the "Ceylon Government Gazette" No. 6,621
of April 24th, 1914.]

INSTRUCTIONS FOR THE GUIDANCE OF SUPERINTENDENTS OF ESTATES AND OF DISPENSERS IN CHARGE OF ESTATE DISPENSARIES.

An estate or group of estates which maintains a dispenser and a suitable building for a dispensary will be allowed a certain amount of drugs free by Government. Government encourages the establishment of such dispensaries in the hope that treatment being placed within easy reach of the labourer, he will avail himself of it at a much earlier period in his illness than he probably would of that at the Government Dispensary, which is, as a rule, at a considerable distance from him.

At the earlier period the illness would most probably yield to such ordinary treatment as the estate dispensers are qualified to give; this would tend to lessen the number requiring hospital treatment, and eventually the hospital mortality, but Estate Superintendents are reminded that the employment of a dispenser does not free them from their obligations to their labourers under "The Medical Aid Ordinance, No. 9 of 1912."

Estate Dispensers are not sufficiently trained, and are therefore not considered qualified to treat serious illness, and in all such cases the District Medical Officer should be sent for to see the patient in terms of section 12 (d) of Ordinance No. 9 of 1912. Superintendents are requested to see this rule duly carried out.

1. Superintendents may obtain such drugs as those prescribed in Appendix A at cost price from Government dispensaries to the total value of Rs. 5 for cash with order, provided that no quantity of any one drug of the value of more than Re. 1 shall be supplied at any one time; and from the Civil Medical Stores, Colombo, to any amount on application to the Superintendent on Medical Form 159 accompanied by a remittance.

2. Superintendents of estates having a dispensary with a qualified apothecary may have such prescribed drugs free of payment to the extent of 50 cents worth per head of the estate labour population per annum.

3. The free drugs supplied to estate dispensaries by Government are for the use of estate labourers exclusively, and shall not be put to any other use whatever.

4. In requisitioning for free drugs for an estate dispensary, Superintendents of estates must confine themselves to the list of drugs published in Appendix A.

5. The half-yearly requisitions for free drugs, to be despatched within a month, must reach the Office of the Principal Civil Medical Officer on or before the dates given below :—

For estates in the Central Province on January 10 and June 10.

For estates in the Uva and Southern Provinces on March 1 and August 1.

For estates in the Sabaragamuwa and North-Western Provinces on April 1 and October 1.

For estates in the Western Province on May 1 and November 1.

6. Drugs required between the half-yearly requisitions shall be applied for by an intermediate requisition (Medical Form 166).

7. Quinine and tincture of opium shall be applied for separately from other drugs, on Medical Form 166 for quinine, and on Opium Form No. 1 for tincture of opium.

8. All columns of requisition forms must be accurately filled up. The "Remaining" column must show the actual amount in stock at date of requisition. Requisitions shall be signed by the Superintendent of the estate and be accompanied by a certificate as in Appendix B.

9. Intermediate requisitions referred to in paragraph 6 will be complied with with as little delay as possible, provided the cost of the drugs will not exceed the amount allowed by Government.

10. The half-yearly requisitions will be complied with within a month of their receipt.

11. The necessary forms, viz., Medical 11, half-yearly Requisition; Medical 166, Intermediate Requisition; Medical 159, Requisition for

Drugs on Payment ; and No. 1 Opium Form can be obtained from the Civil Medical Stores on application.

12. On receipt of an application for drugs on payment, the applicant will first be informed of the cost, and the drugs will be issued without delay when cheque, postal or money order, has been received.

13. All cheques or postal or money orders must be crossed and made payable to the Principal Civil Medical Officer and Inspector-General of Hospitals.

14. Superintendents of scheduled estates can obtain from the Civil Medical Stores any drug on payment in the manner prescribed in paragraph 1.

15. Medicines will not be compounded at the Civil Medical Stores, but such may be obtained from the district hospitals and dispensaries.

16. All applications for drugs should give full directions how the drugs are to be forwarded.

17. Surgical instruments and appliances, stationery, and equipment will not be supplied by Government.

18. Subject to the approval of the Principal Civil Medical Officer and Inspector-General of Hospitals the appointment of a dispenser to the charge of an estate dispensary, continued employment, leave of absence, and the appointment of a temporary substitute shall rest with the Superintendent, who will also pay his salary and supervise his work.

19. It is to be clearly understood that an estate dispensary and its dispenser form no part of the Civil Medical Department or of Government Service, and that no pension rights are attached to the office.

20. The dispenser may collect for the Superintendent, to be forwarded to the District Medical Officer of the station, all reports of births and deaths on the estate under his charge immediately after they occur. These reports are not to be signed by the dispenser or any other person on the estate, except by the Superintendent himself, or any one acting for him, or, in his absence, by the person acting for him. This is a duty imposed on the Superintendent by section 12 (e) of Ordinance No. 9 of 1912.

21. The Superintendent may note on the death report whether the patient was attended by the estate dispenser ; but the fact of his having been so attended does not free the Superintendent of his obligation to send for the District Medical Officer in terms of section 12 (d) of the Ordinance. The attendance of the estate dispenser cannot be considered as fulfilling the requirement of the Ordinance in serious cases.

22. The dispenser shall request the Superintendent of the estate to send for the Medical Officer of the District to see any serious case or cases for which he may require a higher opinion, or in which removal to the hospital might be injurious to the patient, and he shall do so in all cases of prolonged midwifery.

23. The dispenser shall bring to the notice of the Superintendent the condition of the lines or their surroundings likely to injuriously affect the occupants, and suggest remedies.

24. The dispenser shall submit monthly a return to the Provincial Surgeon of the Province of the diseases treated at the estate dispensary on the form which would be supplied him for the purpose.

25. The dispenser shall keep a register of the patients treated by him, and a book in which he is to record all the prescriptions compounded by him.

26. Rules for the guidance of the dispenser as to hours of attending the dispensary and visiting lines on the estate will be drawn up by the Superintendent.

27. The supply of drugs to an estate dispensary will cease when an estate or group of estates will no longer maintain a dispenser.

28. Whenever the District Medical Officer or assistant is sent for to see a case on any of the estates provided with a dispensary, either the one or the other must attend in person. In no case is an unqualified assistant or apothecary to be sent.

APPENDIX A.

| | |
|-----------------------|-------------------------------------|
| Acid, Acetic | Creasotum |
| „ Boric | Creta ppt. |
| „ Carbolic | Cupri Sulphas |
| „ Hydrochloric | Emp. Cantharid. |
| „ Nitric | „ Resinæ |
| „ Sulphuric | Ext. Ergotæ Liquid |
| Alum Pulv. | „ Fillicis Liquid |
| Ammoni Carbon. | Ferri Carb. Sacch Tableta. 5 grains |
| Argenti Nitras | Ferri Sulphas |
| Borax Pulv. | Hydrat. c. Creta |
| Bismuthi Subnitras | „ Subchloridum |
| Camphora | Iodoform c. Acid Boric (1-8) |
| Chlorodyne | Ipecac. |
| Cholera Mist. c. Opio | Jalap |
| Cinchonæ Cortex | Liniment Saponis |
| Condy's Fluid | Liq. Ammon. Fort. |
| Copaiba | „ Ammon. Acet. Fort. |

| | |
|---------------------------------|------------------------|
| Liq. Arsenicalis | Spirit Ammonii Aromat. |
| „ Potass | Sulphur Sublimat. |
| Magn. Carb. | Tinct. Benzoin Co. |
| „ Sulph. | „ Camphor Co. |
| Naphthol Beta Tablets, 5 grains | „ Catechu |
| Oleum Menth. Pip. | „ Digitalis |
| „ Ricini | „ Ferri Perchlor. |
| „ Terebinth | „ Hyoscyami |
| Pil. Colocynt. | „ Iodin. |
| „ Hydrargyri | „ Nucis Vomica |
| „ Rhei Comp. | „ Scilla |
| Plumbi Acetas | „ Zingiber |
| Potass Bicarb. Pulv. | Ung. Calaminæ |
| „ Bromidum | „ Parafin |
| „ Iodidum | „ Hydrarg. Nitras |
| „ Nitras | „ Resinæ |
| „ Tart Acid Pulv. | „ Sulphuris Co. |
| Pulv. Cret. Aromat. | Vin Ipecac. |
| „ Doveri | Zinci Oxid. |
| Rhei Pulv. | „ Sulphas |
| Quinine Sulph. | Zingiber Pulv. |
| Santoninum | Bandages |
| Sennæ Fol. | Cotton Wool |
| Sodii Bicarb. | Lint, Hospital |
| „ Salicylas | Tow |
| Spirit Ætheris Nitrosi | |

APPENDIX B.

I hereby certify that the above statement, to the best of my knowledge and belief, is correct and that the medicines stated to have been expended, were used for the resident estate labourers only.

Date : _____, 191 _____ Superintendent.

C. — RULES FOR DISINFECTION.

(a) For the disinfecting of furniture, excreta and clothing the following are recommended for use :—

1. Corrosive Sublimate Solution (1 in 1,000).
2. Carbolic Acid Solution (1 in 20).
3. Jeyes' Fluid Solution (1 in 50).

(b) For the disinfecting of houses and flooring :—

1. Jeyes' Fluid Solution (1 in 50).

2. Chloride of Lime Solution (1 in 100) or 1 lb. to 5 gallons of water.

3. Jeyes' Disinfecting Powder.

1. By disinfection is meant the destruction of the *contagium, virus* or *materies morbi* of an infectious disease by various means or substances termed disinfectants. It must be thorough, or it is useless.

2. Everything which passes from an infectious patient (excreta, urine, vomit, sputum) should be received into vessels containing one of the following solutions:—

- (a) Carbolic Acid 4 oz. to 1 pint of water.
- (b) Condy's Fluid 1 oz. to 1 pint of water.
- (c) Sulphate of Copper 1 part to 500 parts of water.

Disinfection of House and Infected Room.

(1) If the house or line is a temporary one, the best thing is to burn it when the patient is removed.

(2) If the building is a permanent one.

(a) Wash the furniture with one of the disinfecting solutions aforesaid, and treat the clothes as directed below, burning any article which is useless and can be spared.

(b) All infected clothing too valuable to be destroyed should be immersed in one of the above disinfecting solutions, then at once wrung out in clean water, thoroughly boiled and then freely exposed to the air.

(3) The following table gives the periods of isolation for infected persons and of quarantine for possibly infected persons, which are generally applicable in the case of the following diseases:—

| <i>Disease.</i> | <i>Isolation of the Patient until</i> | <i>Quarantine of Persons exposed to Infection for</i> |
|-----------------|--|---|
| Small-Pox | ... Every scab has fallen off | ... Eighteen clear days. |
| Chicken-Pox | ... Every scab has fallen off | ... Eighteen clear days. |
| Cholera | ... Convalescent | ... One week or until the forces are proved not to contain cholera bacilli. |
| Enteric Fever | ... The temperature has been normal for several days and all secretions, are natural. | ... Not less than ten days. |
| Measles | ... Three weeks have elapsed from the appearance of the rash and all cough and desquamation have ceased | ... Sixteen days. |

| <i>Disease.</i> | <i>Isolation of the Patient until</i> | <i>Quarantine of Persons exposed to Infection for</i> |
|-----------------|---|---|
| Mumps | ... Four weeks have elapsed ... and all glandular swell- ings have subsided | Twenty-four days. |
| Whooping Cough | The end of the sixth week ... if the paroxysmal cough and the whooping have ceased | Twenty-one days. |

(4) If a case of infectious disease proves fatal, the body should be washed with a solution of Carbolic Acid (1 in 20 of water) and cremated or buried with as little delay as possible in a grave fully six feet deep containing Lime Powder.

(5) Persons who have been placed in quarantine as possibly infected in consequence of having been in attendance or in contact with patients suffering from an infectious disease should have themselves and their clothing disinfected at the completion of their period of segregation.

(6) Every one engaged in carrying out any of the above directions or who handles any such sick person or any of his clothes or discharges or anything containing same should at once disinfect his hands by dipping them in one of the above solutions.

D.—VACCINATION OFFENCES.

Cl. refers to Vaccination Ordinance No. 20 of 1886. Regl. refers to Vaccination Regulations published in *Gazette* of June 13, 1890.

Adults.

- Cl. 5 (a) Failed to present himself for vaccination.
- (b) Failed to present himself for re-vaccination.
- Cl. 8 (c) Failed to present himself for inspection at the General muster on estate.
- Cl. 9 (d) Failed to present himself for inspection after vaccination.
- (e) Refused to allow himself to be again vaccinated.
- (f) Failed to present himself for inspection after second vaccination.
- Cl. 10 (g) Wilfully washed out or removed the lymph.
- (h) Wilfully caused or permitted the lymph to be washed out or removed.
- (i) By application or otherwise interfered with or prevented the due perfection.
- (j) Caused applications to be made or otherwise interfered with or prevented the due perfection.

- Cl. 15 (k) Hindered or obstructed in the discharge of the Vaccinator's duties.
- Regl. 8 (l) Refused to allow Vaccinator to examine arm for vaccine marks.
- Regl. 9 (m) Failed to fill in Householders' schedule.
- (n) Failed to furnish Householders' Schedule within specified time.

Parents or Guardians.

Same offences as (a) to (l) inclusive, but in (a) to (f) say "failed to take or cause child to be taken," and in (g), (h), (i), and (j) add "of child."

Regl. 7 (o) Refused to allow Vaccinator to take lymph.

Superintendents of Estates.

- Cl. 7 (p) Failed to cause notice to be published.
- Cl. 18 (q) Failed to—
- (1) Aid and assist.
 - (2) Prevent offences.
 - (3) Give information.

Vaccination affords a protection of the highest value and efficacy against small-pox, a loathsome and disfiguring disease. It is therefore of the greatest importance to secure its protection as early as possible, and it is a wise precaution that not only unvaccinated persons should be vaccinated without delay, but also all vaccinated persons after seven years should be re-vaccinated.

E.—DISLOCATIONS.

A dislocation is the displacement of the end of a bone at a joint. It is often spoken of as "putting a bone out of joint." The signs of dislocation are:—(1) Alteration in the shape of the joint. (2) The end of the displaced bone can be felt through the skin. (3) Alteration in the length of the limb. (4) Inability to move the joint.

Treatment.—The only treatment that is to be undertaken before the patient is sent to the dispensary or hospital or before the arrival of the Medical Officer is to support the limb in the position easiest to the patient.

SPRAINS.

The straining or tearing of the ligaments from the sudden twisting or wrenching of a joint is called a sprain. The signs of a sprain are pain, heat, and swelling in the part immediately following the injury.

Treatment.—The treatment consists in keeping the part at rest; if the upper limb, by supporting it in a sling; if the lower, by putting the patient to bed. Cold evaporating lotions should be applied to the part, or if these cannot be borne hot fomentations. Firm bandaging over abundance of cotton wool is even more useful as it serves to limit effusion and relieve pain.

WOUNDS are classified as (a) simple; (b) poisoned.

(a) *Simple wounds*:—All accidental wounds—(so-called simple)—contain pathogenic germs capable of doing great harm, and if these are virulent and the defences of the body inadequate, may cause death from spreading infection and septicæmia (blood poisoning) in a few days. Specially dangerous wounds are those contaminated with dust and dirt as they are apt to harbour the most virulent bacteria such as those of tetanus, etc.

Treatment consists in arresting hæmorrhage when present, cleansing with an antiseptic such as 1 in 20 carbolic, or 1 in 2,000 corrosive sublimate and protecting with a dressing of boracic or ordinary lint. Painting with tincture of iodine is another good method of disinfecting wounds. A wisp of cotton wool saturated in Friar's balsam may be used for superficial abrasions after disinfection. If the wound suppurates boric compresses should be applied after washing with an antiseptic. Boric compresses are easily made by squeezing out a piece of boric lint in boiling water.

(b) *A Poisoned wound* is one into which some poison has been introduced, e.g., snake bites, mad dog bites, stings of insects, etc. Treatment should be immediate and aim (a) preventing the poison from spreading beyond the wound if possible by tying a string tightly above the wound; (b) at removing the poison from the wound by first sucking it, and cutting out the flesh round the wound, and encouraging a free flow of blood which washes out the poison; crystals of potassium permanganate should then be rubbed into the wound. Brandy, hot coffee, and warmth should be administered if there is a tendency to collapse.

BLEEDING OR HÆMORRHAGE.

Bleeding may take place when any portion of the system of blood-vessels gives way or is opened into. It is either arterial, venous or capillary.

In bleeding from an artery the blood that escapes is of a bright red colour, and spouts out forcibly in quick jerking jets coming from the side of the wound nearest the heart. In the case of injury to a large artery, life is destroyed in a few minutes if the bleeding be not arrested.

In bleeding from a vein the escaping blood is of a dark colour and flows in a slow steady stream from the side of the opening farthest from the heart.

In capillary bleeding the blood oozes from the entire surface and not from any one point as when an artery or vein is injured.

Treatment.—The means for temporarily arresting arterial bleeding until more permanent means can be resorted to by the Medical Officer, are—

- (a) Direct compression of the bleeding point.
- (b) Compression of the artery between the wound and the heart.
- (c) Forcible flexion of a limb upon itself.

In severe hæmorrhage from a limb, *e.g.*, in a large lacerated wound, the easiest way to stop hæmorrhage is by constriction of the limb above by an improvised tourniquet made by twisting loop tied so as to loosely encircle the arm or thigh as the case may be with a stick. The tourniquet should never be applied to the forearm or leg where two bones are present. It should be tightened just sufficiently to stop hæmorrhage and no more. As these tourniquets cannot be kept for more than a few hours without jeoparding the vitality of the hub, quick arrival to a hospital is imperative.

F.—FITS.

Fainting fits may be caused by over exertion in hot weather or by getting into an upright position when weak from disease. A fainting fit is distinguished by the patient falling down in a helpless condition, generally insensible, *without convulsions*. The face and lips are pale, and the surface of the body cold and often covered with a clammy perspiration.

Treatment.—Lay the patient on his back with his head low. Loosen clothing. Sprinkle cold water on his face and neck. Apply smelling salts to the nose, and, when patient is able to swallow, administer stimulants in *very small quantities*.

EPILEPTIC FITS are due to constitutional or local causes. Patient falls with a cry, is insensible, convulsed, foams at the mouth and often bites the tongue making it bleed.

APOPLETIC FITS occur mostly in elderly people inclined to be stout. The patient falls suddenly insensible. The face is flushed, the breathing loud and snorting.

Treatment.—Raise and support the head and upper part of the chest. Apply cold water to the head. Do not give stimulants.

SUN STROKE is the result of excessive heat, the patient falls suddenly, generally insensible, sometimes in convulsions, the skin feels burning hot to the hand.

Treatment.—Carry the patient at once into the shade. Raise the head. Douche the head, neck, chest, and spine with cold water. Avoid crowding round the patient. Do not give stimulants.

DRUNKEN FITS are caused by the drinking of a large quantity of spirits (arrack, toddy, gin, etc.) at one time. The patient falls into a deep stupor, there is a ghastly vacant expression of the countenance which may be bloated. The breath smells strongly of liquor.

Treatment.—Place the patient on his side with head slightly raised and do not allow him to lie on his back. Induce vomiting by tickling the throat, if possible.

FRACTURES.

The immediate treatment of fractures is to handle the injured part with the greatest gentleness so that there may be no risk of further damage to the part. If a limb has been broken apply splints round it so as to render the fragments immovable. No effort need be made accurately to replace the fractured parts, which had better be left to be carried out by the Medical Officer.

G.—POISONING.

A case of poisoning is recognised by—

- (1) The sudden appearance of the symptoms in a person otherwise healthy.
- (2) The symptoms come on soon after food or drink has been taken, and if many have partaken of the meal they will all show symptoms.

Treatment will depend on the poison taken. In the first instance give an emetic. Its object is to produce vomiting. A tablespoonful of mustard or salt mixed with warm water is a safe and easily obtained emetic.

EMETICS should not be given in poisoning by corrosives such as the mineral acids, &c.

H.—DROWNING.

Send without delay for the Medical Officer and treat patient on the spot. Cover him with blankets and dry clothing. The points to be aimed at are the restoration of the breathing and the promotion of circulation. The first is the main point, and efforts should be made to restore it by artificial respiration, which consists in compressing and relaxing the chest fifteen times to the minute.

USEFUL NOTES FOR THE TREATMENT OF ESTATE LABOURERS.

Dysentery is an inflammation of the inner lining of the large intestine followed later by ulceration. There are several kinds of dysentery.—(1) *Amæbic* dysentery, commonly called tropical dysentery, is due to minute animal parasites swallowed in food or drink; it is sometimes followed by abscess of the liver. (2) *Bacillary* dysentery is due to microscopic bacilli. (3) *Irritative* dysentery is due to the ingestion of indigestible substances such as sand and mud when muddy water is drunk. Chills, the eating of coarse indigestible food, drinking polluted water, and dwelling on excreta-polluted soil are all conditions which predispose to dysentery. It is often associated with malarial fever and derangements of the liver. It is sometimes epidemic and is then due to the pollution of drinking water by the specific germ, or the contamination of food, hands, or clothing by infected excreta, or by flies from infected and exposed latrines; it may also be communicated from one person to another by insanitary latrines.

Prevention.—Special attention should be paid to the following:—

Cleanliness of the house and surroundings; boiling of all drinking water and milk; cleanliness of kitchens and latrines and protection of both these from flies; avoidance of chills; warm clothing; digestible food (avoid salads, etc.); thorough disinfection of motions of patients suffering from dysentery with Jeye's fluid or Cyllin before being disposed of.

Symptoms may be mild or severe, and if neglected are apt to become serious, and render the sufferer an invalid for life. It usually begins with ordinary diarrhoea, griping, and straining. The desire to defæcate becomes incessant and distressing, and the small quantity of blood and mucus passed gives no relief.

Treatment should be prompt. For mild cases a dessertspoonful of castor-oil with 20 drops of landanum should be given at once. If no doctor is at hand 20 grains of ipecacuanha in pill form may be given preceded $\frac{1}{4}$ an hour before by 20 drops of landanum. These should be taken on an empty stomach. The best treatment, however, is a tea-spoonful of Epsom Salts or sodium sulphate dissolved in an ounce of cinnamon water to which 5 drops of dilute sulphuric acid are added; this should be given four times a day until the blood and mucus have disappeared from the stools. Emetine is the sovereign remedy for

amœbic dysentery; it is best taken in the form of subcutaneous injections; the patient should avail himself of this at the hands of a doctor as soon as possible.

Diet should be rigid and sparing until the motions become solid, and should consist of arrowroot, rice water, barley water, and sago given in small quantities every fourth hour. On no account must the cooly be allowed curry and rice for which he will ask, but after a fortnight or so he will be able to gradually resume his ordinary diet. In chronic dysentery nothing but the most persevering treatment will be of avail.

Worms.—This disease is common to almost all, but more especially to children over one year old. Castor-oil and Santonine should be given if the patient complains of griping pains in the stomach. A wine-glassful of castor-oil (small doses are ineffective in cooly cases) with two Santonine tablets (2 grains each), or as much Santonine as will moderately cover a ten-cent piece can be given to adults who are not debilitated. For children from ten to fifteen years half the foregoing dose, and from three to ten years a quarter of the dose should be given. For a child of one year a table spoonful of castor-oil and not more Santonine than can be put on the point of a penknife.

Santonine and castor-oil are *best given together*, but another way is to give Santonine and rhubarb for three to six evenings and a sufficiently large dose of castor-oil at the end.

Ulcers.—These are very common and should not be neglected or allowed to fester. There are three stages of ulceration (1) The spreading stage, when the ulcer is painful, inflamed, discharges profusely and covered by a foul slough. (2) Intermediate stage. (3) Healing stage, when clean healthy bleeding granulations are present. The treatment should vary according to the stage. During the spreading stage boric compresses are the best; they are made by rinsing out boric lint in boiling water and applying to the ulcer twice or three times a day, or ordinary lint soaked in hot boric lotion (a tea-spoonful to a cupful of boiling water) may be used; compresses made with Condy's fluid, too, form an excellent dressing. Boric ointment, boracic acid powder and zinc ointment are all good antiseptic dressings. If the ulcer grows above the level of the skin it should be touched with copper sulphate (blue stone). The patient should lie up to ensure a speedy cure. Most ulcers if kept clean and aseptic can be treated on the estate. If an ulcer is quite clean it will have almost no odour.

Itch.—Personal cleanliness is essential to cure itch and prevent its recurrence. Frequent ablutions with plenty of carbolic soap and the application of sulphur ointment (after scrubbing open the pustules with a hard brush) are the best remedies.

Malarial fever, perhaps the most important tropical disease, is due to a minute parasite which gains entrance into the body and lives in the blood, there causing destruction of the red blood cells. When the parasite enters the red blood cell it develops at the expense of the latter, becomes segmented or rosetted, and finally breaks down the cell and escapes as segments or spores into the blood stream. Each spore is now free to attack another red cell and undergo the same development, repeating the cycle, and discharging another brood into the blood. During the time the spores of the parasite are free in the blood, the white corpuscles of the body attack and digest them; they are also destroyed in the liver, spleen, and marrow. When the fever continues for a few days, the parasite, instead of breaking up into spores in some of the corpuscles, form crescent bodies (a maturer form of the parasite) which do not undergo segmentation, but which, when taken up by its future host, the female anopheles mosquito (the male is harmless) is capable of further development. Reaching the stomach of the mosquito some throw out whip-like wriggling processes, others small protuberances; these unite and form an egg-cell which assumes a worm-like shape, bores its way through the stomach wall of the mosquito, becomes round and enlarged, and develops within it needle shaped spores. When the cell bursts these spores escape into the different organs of the mosquito; some find their way into its salivary gland which is connected by a duct with the proboscis, and in this way are capable of being transferred to a healthy subject attacked by the mosquito. The malarial parasite has thus two phases of existence, a human phase and a mosquito phase. Man is infected by the mosquito, and the mosquito by man. An infected mosquito will infect, in eight or ten days, any healthy person she bites. Malaria is thus an infectious disease, and in malarious districts the mosquito (which however must herself first be infected) carries it from one person to another.

Treatment of the attack.—Hot drinks like tea, cungi, and coriander water can be given in the acute stage. Quinine is best given when the fever has subsided, large doses are necessary, two (or sometimes more) 5 grain tablets, or as much as can be well piled on a rupee can be taken by an adult and proportionate doses by children. The quinine treatment should be continued for some days after the fever has left.

Prevention.—A patient suffering from malaria is a source of infection to every one near him, and even to his neighbours, if there are any anopheles mosquitoes about. As the life of the mosquito is intimately associated with water in which its eggs are laid and in which the larval and pupal stages develop, sanitary measures should be directed towards the removal of collections of stagnant water. As the habits of the anopheles are nocturnal malarious localities should be visited during the day if possible. If residence at night were imperative early retirement to bed under a *mosquito curtain* with fine mesh (20 to the inch) is essential. A person suffering from malaria should be scrupulously protected from the bites of the mosquitoes by mosquito nets until he is well, for if not any anopheles feeding on him will be infected and in eight or ten days will be capable of infecting any person she bites. The net should not fall on to the floor, but be tucked under the mattress, as mosquitoes may hide under the bed. Also, as the limbs during sleep come in contact with the curtain and are liable to attack, the lower part of the net for a foot should be of double calico. For residents in malarious localities a mosquito house protected with wire netting, is better than a mosquito net. Mosquitoes inside the house are destroyed by fumigating the rooms with burning sulphur, pyrethrum, tobacco smoke, or wood smoke. Sulphur is burnt in an iron pot placed in a tub or basin of water to prevent the burning sulphur falling on the floor. One should be indoors between sunset and sunrise, and, if obliged to go out at night, thick gloves and veils should be worn as well as putties and boots with long tops. Retiring within doors before sunset into a mosquito-proof house was shown by itself to be efficacious in the Roman Campagna during the malarious season. By such means as these people are able to live in malarious districts without contracting malaria.

Destruction of breeding places.—Mosquito larvæ must have water to live in, without it they die. The larvæ are found in ponds, small water-courses, and ditches at the margins where the water is quiet and weeds rife; they

are generally absent in large collections such as marshes, lakes, and rivers, especially where fish abound, as these eat the larvæ. A week must elapse before eggs can hatch into mosquitoes. Every week therefore pots and other receptacles about the house containing water should be emptied and dried, puddles brushed out, vessels and reservoirs storing water for drinking, etc., should be emptied and dried before refilling. Reservoirs, ponds, etc., too large to be emptied, may be treated with petroleum or kerosine. Larvæ have to come to the surface to breathe and if a thin film of petroleum or kerosine be spread over the surface they get suffocated and drown. The oil may be spread on the surface with a rag on a stick. An old tar-barrel placed in the pond is excellent and gives a more permanent film than petroleum. The barrel should be taken out, re-tarred, and re-inserted once a fortnight. Drinking-water, tanks, and reservoirs are best protected with mosquito netting.

Quinine as a prophylactic.—During the malarial season, which corresponds with the rainy season, especially at the commencement and end, five grains of quinine or equinine should be taken daily or fifteen grains may be taken on two successive days every ten days. Persons who have once had malarial fever should take quinine systematically on and off for at least two years.

Rules for the Administration of Quinine on Estates where Malaria is prevalent.—For two weeks before the unhealthy season may be expected to begin quinine should be given as a preventive in the following manner, viz. :—Ten (10) grains a day to every adult on two successive days every week. Half or quarter of the dose to all children, according to their ages, in the same manner. The quinine should be given in solution when practicable. The solution can be made in the following manner: put half an ounce of quinine in an ordinary beer or whisky bottle, nearly fill with water, shake, and then add half an ounce of dilute sulphuric acid and fill up with water. The bottle will then contain 24 adult doses of one fluid ounce each.

2. When fever breaks out this preventive treatment is to be continued.

3. Every adult or child attacked with fever should have a dose of quinine twice a day, and these doses should be continued for three days after he is apparently free from fever; the preventive doses twice a week should be continued for two months, or during the fever season.
4. A sick check-roll should be kept, and every dose of quinine administered should be shown against the adult's or child's name.
5. The periodical issue of rice or other allowance should not be stopped for absence from work if the check-roll shows the cooly is sick and taking quinine.
6. The sick check-roll should be examined and checked by the Superintendent or Assistant Superintendent every day.
7. On estates where a Dispenser is employed the quinine should be administered and the sick roll kept by him; where an Estate Dispenser is not kept these duties should be performed by some person of intelligence, who should have no other work.
8. Whoever performs the duty of administering quinine or any other medicine should not give any to the sick cooly or his friends to take at some future time, but should put the quinine in the patient's mouth and see him swallow it. He should visit the lines every day, or twice a day if there are sick in them, and see that every cooly gets treatment, whether he is a working cooly, or a loafer, or a visitor.

Bronchitis, Pneumonia and sore throats are common during the monsoon. Pneumonia can be generally diagnosed at the beginning by continued fever, cough, pains in the chest, and anxious countenance and hurried breathing. Early and effective treatment is necessary but cases should not be moved any distance to the hospital without medical advice. Warm clothing, simple nutritious diet and the application of a mustard plaster are perhaps all that need be done before the doctor arrives.

Acute Diarrhoea.—Generally caused by eating unripe fruit or badly cooked vegetables, rotten meat, &c., &c. Signs are, frequent watery stools, vomiting, cramp in the legs, thirst and restlessness. As the disease is dangerous prompt measures should be taken.

Treatment.—Before the medical officer arrives chlorodyne 10 drops in water, laudanum 25 drops in water or two table-spoonfuls of the cholera mixture (Government dispensary) may be given every two hours according to the urgency of the case.

A mustard plaster should be applied to the nape of the neck, stomach and legs and hot applications to the hands and feet.

Consumption can be generally diagnosed from a cough of some duration, the patient getting thin, and in the later stages spitting blood and being subject to night sweats.

The treatment takes a long time, and in most cases it is better to send the cooly to the coast, where the climate is not so variable.

Measles.—This disease is known by the presence of fever, a rash about the size of pin heads in the shape of crescents forming on the body, cough and watering of the eyes, &c.

Treatment.—The disease is harmless in this climate, chills should be prevented, cough mixture and boric lotion to the eyes are needed in some cases. Strong purgatives should be avoided.

Chicken-pox is preceded by continued fever, aching in the back, loins and joints, and eruptions like small blisters about the size of a coriander seed, especially the face, back, chest and arms.

Treatment.—Cungu diet during the fever stage, some carbolic vaseline may be rubbed in to ease the itching and lessen the spread of the disease. It is quite harmless in this country.

Small-pox.—Much the same symptoms as chicken-pox, but more severe. The eruptions are more numerous and become pitted in the centre. Vomiting can also be expected.

When the ulcer is clean and has no odour, it should be washed with a mild antiseptic such as boric or carbolic (1 in 40) and dressed in an ointment such as boric or equal parts of boric and zinc; the ointment should be very thinly applied on a piece of lint or cloth cut to the size of the ulcer. Most frequent changes of dressing at this stage is not beneficial.

NOTES.—All cases of infectious diseases should be notified to the D.M.O. in order that proper precautions may be advised, and in the case of small-pox the patient should be isolated immediately.

For epidemics, such as influenza, which occur during the monsoon season special medicines can be obtained from the Government dispensaries free of cost.

HOW TO ACT IN CASES OF POISONING.

Send at once for a doctor. Preserve any suspected bottle, medicine, food, etc., as evidence. Make a quick search for any definite description of the poison—bottle, label, etc. Prussic Acid, etc., may often be at once recognised. If the nature of the poison is discovered the treatment specially adapted can at once be given.

If there is no clue to nature of poison proceed as follows:—

1. Discover if lips or clothing are burnt. If they are, corrosive poison is present and *an emetic must on no account be given.*
2. If the patient is unconscious an emetic must not be given. Rouse him at once by speaking, shaking, etc. Do not use Smelling Salts. If pulse is weak and breathing low use artificial respiration.
3. If no corrosive has been taken and patient is conscious administer an emetic at once, even if the exact poison is unknown. Emetic:—Tablespoon of mustard in tumbler of tepid water. Aid emetic by placing finger or feather well into throat.
4. In *all cases* it is a good plan, if the patient can swallow, to give milk or beaten up eggs, or strong tea or coffee, or salad oil. This may be given either before or after emetic. Treat the consequent shock of poisoning with warmth, especially to abdomen, and stimulants. Do not let patient sleep.

CORROSIVE POISONS.

(Never give Emetic.)

| <i>Poison.</i> | <i>Antidote.</i> |
|--|--|
| Vitriol or Sulphuric Acid, Nitric Acid (<i>Aqua Fortis</i>) Spirits of Salts (<i>Hydrochl. Acid</i>), Burnett's Fluid. | Magnesia, washing soda, chalk or whiting in milk; afterwards salad oil and a little ice. |
| Carbolic Acid. | Lime water; then salad oil or milk; later on Calomel salts. |
| Oxalic Acid. | Chalk or whiting in milk or water (scrape <i>chunam</i> off the walls and crush it). Afterwards brandy and warmth. |
| Ammonia; Caustic Soda; Potash; Quicklime. | Lemonade or vinegar in copious doses with plenty of water. Afterwards salad oil and ice to suck. |

NON-CORROSIVE POISONS.

(Always give Emetic, unless unconscious.)

After emetic administer antidote. Use artificial respiration if necessary.

| Poison. | Antidote. |
|--|---|
| Aconite | Brandy; warmth; castor-oil. |
| Alcohol | Hot coffee; Epsom Salts. |
| Belladonna, Deadly Nightshade, Eye Lotions that dilate pupil, Liniments of treachy appearance. | Brandy; hot coffee; lemon or limes to suck, (Delirium may arise). |
| Metallic Poisons: arsenic, copper, lead, mercury, zinc, etc. Rat paste. | Egg and milk; brandy; warmth to abdomen. |
| Nicotine. | Stimulants. |
| Opium or Morphia (occurs in Chlorodyne, Dover's Powder, God- frey's Cordial, Laudanum, Nepen- the, Paregoric, Winslow's Soothing Syrup.) | Small tumbler of water made bright red with Permanganate of Potash or Condyl's Fluid. Hot coffee. Keep patient awake; squirt cold water in face; flick with wet towel. |
| Phosphorous (Rat Pastes.) | Condyl's Fluid made bright pink in water; or Sanitas, tablespoonful in water; then egg and milk. |
| Prussic Acid and Cyanide of Potassium. | Use Smelling Salts. Artificial respiration. |
| Strychnine (<i>Nux Vomica</i>) | Keep patient quiet; darken the room; avoid light and sudden noises. |
| Fungus; Toad Stools. | Brandy, warmth, castor-oil. |

SIMPLE RULES OF HEALTH.

Clean Residences. Have every place you reside in cleaned regularly and thoroughly. In houses the interior of rooms should be coloured white, in order that dirt and insects may more readily be seen.

Refuse should be burned daily, and that which cannot be so dealt with should be emptied into holes in the ground, and at every deposition earth should be thrown on top of the refuse. The holes should be at some distance from any habitation, and to the leeward.

Keep the ground around habitations clean, and do not let pools of water remain near it, as mosquitoes lay their eggs in water. The site on which the house is built or the tent pitched should be on a slope, not in a hollow, so that water can drain away. Verandahs are excellent, but should not be full of plants

There should be a gravelled space around a house and a cleared space around a tent, to prevent snakes coming too near. Water cisterns should be covered with wire gauze to prevent mosquitoes breeding in them. Wells should have iron covers, and the water drawn by a side pump. Rooms should have ceilings. Always carefully examine your boys' rooms, and latrines, and see that they are clean.

Take care not to leave empty tins, coconut shells, broken bottles, &c., in the compound near the house, as water gathers in them and mosquitoes breed in the water. Bury all these articles, or burn them.

PERSONAL.

Always have a good bath after the day's work.

In order easily to get rid of ticks, soap yourself well all over and let the soap remain on a little time. In order to keep off ticks, oil (weak Carbolic, 1 in 80) yourself before going out and have a good bath on coming back.

Scrubbs' ammonia is useful in the bath, and for application to mosquito bites.

Try to avoid chills by having the bath water slightly warmed, by changing damp clothes, and having a warm bath or good rub down, and then a hot cup of tea, if you get wet. Do not take a cold bath when heated.

Take care to have a warm cover over your stomach at night, and always have a rug or blanket ready to draw up over you if the night becomes cold.

Do not sleep without some sort of a sleeping suit. Do not sleep in verandahs or in the open, because chilly breezes may spring up during the night.

Take care that all clothes, bed linen, &c., are properly dried by being hung in the sun on a dry day, or dried by a fire on a wet day.

Do not expose yourself to the sun without a proper protection against its rays, such as a topee lined with red or yellow or both.

Always dry yourself well after a bath, and if inclined to prickly heat use the Dusting Powder in any place where redness, &c., may be noticed.

Use a lamp when going about after dark in the jungle, as snakes are not uncommon.

It is advisable to have a good cook when travelling, and to see that he does his work. A good boy or cook to wait on you can be obtained for Re. 15 to Re. 20 a month and 25 cents batta a day.

Always wear woollens next to the skin. Especially be careful of chills in the north-east monsoon.

HOW TO AVOID DISEASE.

GENERAL.

1. Disease and sickness are caused by germs or seeds of diseases entering the body. These germs are exceedingly small and cannot be seen without a microscope. They enter the body in many ways—in the air that is breathed, the food that is eaten, the water that is drunk, by the bites of insects, and by any dirty thing that breaks the skin.

2. The air of houses is best kept purified by keeping the doors and windows open, so that fresh air may come in from outside.

3. Let food be well cooked, and see that after cooking dirt and dust do not get into it, and that flies do not settle on it, as flies often carry germs on their feet from filth to food.

4. Let the drinking water be clean, and kept in clean glass bottles from which it can be poured, and not in a chatty or any container from which it can only be got by dipping a cup into it, as if the cup or hand holding the cup is dirty, all the water becomes bad.

5. Keep houses free from flying insects, such as mosquitoes and flies, and clothing and bedding free from fleas, bugs, ticks, lice, &c.

6. When the skin is cut, or torn, or injured, so that blood comes, wash the wound well with clean water as soon as possible, and cover it with a clean piece of cloth, and if you live near a dispensary go there and have it dressed properly. Remember that lock-jaw (tetanus) is generally caused by wounds which have not been properly dressed from dirty sticks, thorns, sharp stones, &c.

7. Heat will kill all disease germs; therefore, the best way to purify water is to boil it, and after boiling to set it aside to cool, well covered to prevent dust and flies getting to it. Boiling is the best way to destroy germs of disease, and bugs, lice, &c., in clothes, and thorough cooking is the best way to make any food wholesome. Fruit and vegetables to be eaten raw should be washed in clean water.

8. Any bedding, clothing, or article which has been used for a sick person should not be used by another until it has been boiled and washed. Mattresses and pillows if soiled should be destroyed, and if not soiled they should be exposed to the sun for three days before being used again.

9. Separate any sick person from the rest of the household.

10. Flies feed and breed on manure and filth; therefore, bury all excreta and refuse, or, if possible, burn it.

11. Mosquitoes breed in still water; therefore take care that there are no pools or small collections of water near the house. Bury all empty tins, coconut shells, and small articles that collect rain. Sleep, if possible,

under a mosquito netting tent at night. Malarial fever is caused only by the bite of a mosquito, and if there were no mosquitoes there would be no malaria.

12. Small biting insects creep on the ground; therefore keep all floors clean and well swept.

13. All disease germs thrive best in dark damp places: therefore keep houses dry, and let in as much light as possible.

14. Milk should not be drunk or used for food until it has been boiled; after boiling it should be kept in a clean vessel and covered over to keep out flies and dust.

15. When sweeping, avoid raising the dust by sprinkling the floor or ground with water.

16. Do not throw dirty cooking or bathing water on the ground, but into a drain or pit.

THE DANGER OF FLIES.

Flies and Disease.

The house fly lays its eggs in rubbish heaps, stable manure, cattle manure, human excreta, and decaying matter of all kinds. The egg takes about two weeks to hatch out, and become the mature fly.

If you are troubled with flies it proves the existence of filth in the neighbourhood.

Flies are amongst the most dangerous insects known to man. Flies are the filthiest of all vermin. They are born in filth, live on filth, and carry filth around with them.

Flies are known to be carriers of millions of death-dealing disease germs.

Flies may infect the food you eat. They come to your kitchen, or dinner table, straight from ash-pits, privies, latrines, manure heaps, decaying animal or vegetable matter, from the sick room or elsewhere, with all sorts of filth and disease germs on their feet and in their stomachs, which they deposit on your food, so that you may constantly be eating filth and myriads of disease germs, and thereby acquiring different kinds of disease.

Flies may infect you with consumption, typhoid fever, cholera, dysentery, diphtheria, and other infectious diseases. Flies, after feasting on the sputum of consumptive persons and the discharges from persons suffering from dysentery, typhoid, cholera, and other infectious diseases, go direct to your food, to your drink, to the lips of your sleeping child, or perhaps to a small wound on your body, and so convey disease.

Do not allow flies in your home.

Do not permit them near your food.

Do not buy food-stuffs where flies are tolerated.

Do not eat where flies have access to the food.

Cause, therefore, all rubbish and decaying matter near your house to be burnt, or removed and buried, two or three times weekly, and use coir-dust, earth, or disinfectants in your latrines, then you should have no nuisance from flies.

If in spite of these precautions you are still plagued by flies, write or inform the Health Authority or Sanitary Inspector, as there must be breeding places in your neighbour's premises.

It is almost useless to attempt to cope with the fly pest by means of fly papers, &c.

A fly-infected house is not fit to live in.

Flies in the home indicate a careless housekeeper.

Flies prefer close and stuffy rooms to airy and well-ventilated ones.

The points to be specially noted are :—

Flies breed in filth.

They are a sign of unhealthy surroundings or of bad management.

Prevention is better than cure.

Remember, no dirt; no flies.

Burn all rubbish, &c., in your garden every two or three days.

Do not let heaps accumulate.

Protect your food and drink from flies.

Ash-bins and ash-pits should be covered, and after being emptied should be sprinkled with a disinfectant.

Flies are specially attracted to human excrement: use coir dust, earth, or a disinfectant in your latrine pail.

Manure should be removed from the proximity of dwellings once a day.

If flies are present in your home, catch the flies as fast as they appear. Use liquid poisons, sticky fly-papers, and traps.

Place the following fly poisons in shallow dishes or soup plates throughout the house :—

(a) Two teaspoonfuls of formaldehyde solution in one pint of sweetened water, to be renewed daily; or—

(b) Sodii Arsenit $\frac{1}{4}$ lb., sugar 1 lb., water 5 gallons.

K. MCGAHEY,

Senior Sanitary Officer, Ceylon.

FOOD AND DRINK.

Water.—In order to keep in good health it is most necessary to be careful that the water which you drink is good and wholesome.

Water from springs and deep wells is generally good. A deep well does not mean one which is simply a number of feet deep, but one which has passed down through an impervious stratum into a stratum pervious to water, which is therefore generally pure, because it has had a long way to travel through the earth before reaching the well.

River and stream water is apt to be polluted by the faecal matter, &c., of the cooly lines or villages along its course, and hence no matter how clear it may look it may be very dangerous.

Purification on a small scale.—Be extremely careful with all water you are to drink to see that it is filtered through the Berkefeld filter, then boiled, and poured into a clean bottle, which when partially filled should be shaken to aerate the water, and finally corked.

To cool water, fit the bottles with little flannel jackets sewn on, damp the flannel well with water, and hang up in the breeze or outside the bullock hackery. If the water is very thick, add a speck of alum (6 grains to the gallon) to send the mud as a deposit to the bottom, when the clear water can be decanted off and then filtered and boiled. The water in the enamelled iron water bottle can be cooled by damping the felt cover with water and allowing evaporation to take place.

Iced drinks should not be used too cold.

Lime drinks are very good.

Food.—Inspect your kitchen regularly and see that it is kept clean, and that the pans, &c., are in good order.

See that all food is clean, particularly green food. Worms, &c., are the penalty of not attending to this, as all green vegetables abound with the eggs and young of worms.

Coconut water is very good in the early morning.

Chickens must either be killed and cooked at once, or must be hung for hours. The toughness of the bird is not because of some inherent wickedness on the part of the Ceylon chicken, but because it is either not cooked soon enough, i.e., within 10 or 15 minutes of being killed, nor hung sufficiently long for the stiffness to disappear. The same remarks hold good for game.

CONSTIPATION.

It is a most important matter to keep the bowels regularly open.

Habitual constipation.—If suffering from habitual constipation, take one Aloin Pill regularly at night before going to bed.

Occasional constipation.—Two tableids of Blue Pill, Colecynt, and Hyoseyamus (Saturday night pills), taken at night will cause the bowels to be opened several times the next morning. If the liver is out of order a dose of Calomel, 2 to 3 grains, will open the bowels and relieve the liver.

If **any** of these purgatives do not act, then a dose of Magnesium Sulphate (Epsom Salts) should be taken in the morning.

Prevention.—Constipation can often be avoided by eating ripe fruit, particularly the first thing in the morning.

SUN EXPOSURE.

The effects of sun exposure are sometimes experienced in the shape of intense headache, high temperature, burning skin, and perhaps delirium.

Treatment.—Cold sponging as for malarial fever, open the bowels with Calomel (see Constipation), keep the sick man in a cool dark place, and take him to a medical man as soon as possible.

Food.—Soups, milk, Brand's essence, Liebig, &c.

Stimulants.—None, on any consideration whatever.

FOREIGN BODY IN THE NOSE.

Blow violently down the nostril in which it is lodged, at the same time closing the other nostril.

WOUNDS.

Simple Wound.—Bathe with solution of Permanganate of Potash.

If very small, apply plaster.

If large, soak some lint in Boracic Acid solution, wring dry, and apply to the wound and fix with bandage.

If very large, bring together with a stitch, *i.e.*, by using the silk and needles in case. See that the needle is not rusty and that the silk is clean.

Small Abrasion (Sore).—This may be treated by the application of Hazeline Cream, which is especially useful for sores on the feet.

Poisoned Wound.—Applying fomentations every three hours or oftener until the inflammation subsides. It is a very good plan to put the part, if an arm or leg, in a bath of hot water in which you have dissolved 3 or 4 Boracic Tableids, when you change the fomentation.

BITE OF MAD DOG.

The wound made by the bite should be washed and dried and cauterized by crystals of Permanganate of Potash, care being taken not to overdo the cauterization. Further treatment must be done at the Pasteur Institute, Kasauli, North India. (And at Coonoor.—*Ed.*)

SNAKE BITE.

Tie a tight bandage above the bite if it is on the arm or leg. Then cut quickly round the marks of the fangs with a knife, and remove the bit of skin with deeper parts; wash well with a strong solution of Permanganate of Potash, or merely rub the crystals into the wound, or burn the part well with anything handy. Hot fomentations to be applied every half hour for some time and then less frequently. Give brandy to the sick man.

GUNSHOT WOUNDS.

Do not attempt to get the bullet out.

Dress with Boracic lint, as under "Simple Wounds." When able to move, go to or send for a medical man.

STINGS OF WASPS AND BEES.

Take the sting out. Put a drop of Scrubbs' Ammonia on the spot. Rub with Castor-oil.

LEECH BITES.

Leeches are very common in Ceylon. Guard against their bite by wearing carefully laced boots and putty pattern of leggings.

USEFUL DRUGS FOR ESTATE USE.

The following medicines will be found useful; besides those generally kept on the estate, only a few of them are obtainable from the dispensary:—

Acetic Acid.—Same as Chloride of Ammonium.

Acid Boric.—"Borofax" is an antiseptic ointment which contains boric acid, and is useful for dressing cuts, burns, ulcers, etc. See also Iodoform.

Antipyrine.—Similar in action and dose to phenacetin, q. v.

Bismuth Subnitrate.—Dose for children 2 to 5 grains; for adults 5 to 15 grains in diarrhoea and dysentery. Can be obtained as compressed Tabloids, five grains in each.

Borax.—3 drams in 8 ounces of water make a useful gargle for a bad throat—a little honey may be added to it to make the gargle less disagreeable. Tabloid Borax slowly sucked has the same effect as a gargle.

Bromide of Potassium.—Dose 5 to 30 grains.

Caffeine.—Dose 1 to 5 grains; see Phenacetin.

(Simple Medical Directions for the use of Government Officials in Ceylon. By Dr. Chalmers, Government Record Office, Colombo, Re. 1).

Calomel.—*Vide* "To make Black Wash."

Chloral.—Dose 5 to 30 grains; a draught of 10 grains of chloral and 10 grains of bromide of potassium in a wine-glassful of water in cases of sleeplessness.

Chloride of Ammonium.—Useful in making a cooling lotion for fever, headaches or contusions. Tabloid Ammonium Chloride is taken internally in disorder of the Liver and also in bronchitis, or sucked to relieve sore throat.

Cocaine.—*Vide* under "Prescriptions."

Cresote.—*Vide* under "Prescriptions."

Glycerine.—A pinch of cocaine in a teaspoonful of glycerine and laudanum is efficacious in earache.

Hazeline.—A useful drug in bleeding from lungs or stomach, dose half to a teaspoonful every fourth hour.

Iodide of Potassium.—Dose 5 to 30 grains.

Iodoform.—Used as a local application to wounds and ulcers either as a powder plain or mixed with an equal quantity of boracic acid.

Liq. Hydrargyri Perchloride.—(Solution of perchloride of mercury) a wine-glassful of the solution in a half tumbler of water is useful for washing wounds and ulcers.

Liquid Extract of Ergot.—*Vide* under "Prescriptions."

Liquor of Subacetate of Lead.—3 teaspoonfuls of the liquor in a pint bottle of water is useful in contusions and sprains and a couple of teaspoonfuls of laudanum may be advantageously added to the lotion to reduce pain.

Potassium Permanganate of Potash.—Useful as a disinfectant or deodorant.

Phenacetin.—5 grains with 3 grains of caffeine is useful to relieve headache or neuralgic pains. One or two Phenacetin compound Tabloid (which contain caffeine) can be used.

Pedophyllin Pills.—Obtainable at the Government dispensaries—1 or 2 at bed-time followed by a dose of seidlitz powder in the morning if necessary.

Potash Chlorate.— $\frac{1}{2}$ oz. in 6 ounces of water makes an efficient gargle for bad throats. Tabloid compressed potash chlorate slowly sucked is equally effective and more convenient.

Rectified Spirits improves the action of lead or arnica lotions added in the proportion of 3 or 4 teaspoonfuls to the pint.

Sal Volatile.— $\frac{1}{2}$ teaspoonful in water is useful in sick stomach and as a stimulant.

Sulphate of Zinc.—*Vide* under "Prescriptions."

Tincture of Arnica.—A teaspoonful in half a wine-glass of water is a good lotion for sprains and contusions.

A FEW PRESCRIPTIONS.

For Sore-Eyes.—Collyrium of sulphate of zinc 2 grains, in 1 ounce of water; or acid boric 2 grains, in 1 ounce of water.

Lotion of Sprains & Bruises.—Tincture of arnica 1 dram, water 1 ounce; or liquor of subacetate of lead 4 drams, laudanum 2 drams, rectified spirits half ounce, water 8 ounces.

To make Black Wash.—Calomel 30 grains, lime water 10 ounces.

Carbolic Lotion.—Carbolic acid 1 ounce, water 2 pints.

Carbolic Oil.—Carbolic acid $\frac{1}{2}$ to 1 dram, olive oil $12\frac{1}{2}$ to 19 drams.

Cooling Lotion for Fever Headaches.—Chloride of ammonium $\frac{1}{2}$ ounce, nitre $\frac{1}{2}$ ounce, rectified spirits 1 ounce, acetic acid dilute $1\frac{1}{2}$ ounces, water $5\frac{1}{2}$ ounces.

For Toothache.—A solution of 3 grains of cocaine in 30 drops creosote put in the hollow of the tooth.

For Earache.—3 grains of cocaine in a small teaspoonful of glycerine and laudanum dropped into the ear.

For Headache and Neuralgic Pains.—Phenacetin 5 grains with or without 3 grains of caffeine—caffeine counteracts the depressing effect of phenacetin. A five grain Phenacetin Tabloid or one or two Phenacetin compound Tabloids may be used.

For Child-birth.—A teaspoonful of liquid extract of ergot, in a wine-glassful of water, to be given immediately after birth.

To make Lime Water.—A pound unslaked lime. A pint and half of water. Pour in the water slowly and keep stirring, leave for a few hours and pour off without the sediment. Keep well corked.

For Worms.—Give Tabloid Santonine for 3 evenings and castor-oil on the next morning. Dose for adults 5 grains.

For Burns.—Zinc ointment or bread poultices may be applied if there are no blisters. If there are blisters, prick them, apply lime water and cover up with cotton wool.

For Snake Bites.—Have no fear about cutting out the bite, lift the skin and cut out the marks of *both* fangs. Patient should be kept moving about, and plenty of stimulants given.

Quinine should be taken after a meal, preferably after early tea.

(Dr. Chalmers.)

For Scorpion Bites, prevent absorption by a proximal ligature, open the wound by an incision and apply a weak solution of ammonia.

RINDERPEST.

Symptoms:—High fever; animal refuses food; ears drooped; quickened breathing; hair erect over the back; sometimes shivering; discharge from eyes, mouth, and nose; eruption resembling scales of bran inside mouth and on the body; bowels at first constipated, but soon acute diarrhoea sets in; dung has a foul smell and is highly infective, and contains blood and mucus.

IMMEDIATE STEPS.**Instructions for the Public.**

1. Inform nearest Headman, Police Officer, Vidane, or Stock Inspector at once of any sick or dead animal.
2. Isolate sick animals in **fenced enclosures** at a distance from roads or public places.
3. Isolate contacts in the same way.
4. Burn all dung, straw, litter, or waste food. Use tar and disinfectants freely, when available.
5. Bury carcasses within six hours after death at least six feet deep, to prevent dogs and pigs digging them up, and cover them with quick-lime, if possible. It is still better to burn carcasses, if fuel is available. Owners must bury or burn the carcasses of their cattle: if they fail to do so, the cost incurred by Government in burying or burning the carcasses will be recovered from them by the Police Magistrate in the same way as a fine under section 15 of Ordinance No. 25 of 1909.
6. Bathe, and boil your clothes after tending diseased or suspected cattle, to avoid giving the disease to healthy cattle.
7. Do not allow your cattle to go near infected places or roam about. Tether neat cattle, and herd buffaloes.
8. Do not keep sick cattle or contacts in galas, or on or near roads or public places.
9. Disinfect galas thoroughly after an outbreak of disease.
10. Do not put healthy cattle in galas where there has been disease, even after disinfection, as the disease may not have been stamped out. Carters should avoid galas during an epidemic, and camp at clean places on the road.
11. Do not overcrowd galas with cattle.
12. Owners of cattle must supply them with food and water and pay costs of their detention.

ADDITIONAL INSTRUCTIONS FOR HEADMEN AND POLICE.

13. See that the foregoing instructions are promptly obeyed, especially Rules 2, 3, 4 and 5.

14. Inform nearest Medical Officer or Stock Inspector of any outbreak of disease, also your immediate official superior, who will inform the Government Agent by telegraph or quickest means.

15. Stop removal of cattle from infected areas, except on a permit from the Government Agent.

16. Stop the issue of cattle vouchers in infected areas.

17. Prevent sick cattle, whether attached to carts or not, being driven along any road, and detain contacts until inspected and permission obtained from the Government Agent for them to go on.

18. Seize cattle straying on the roads or in public places (Ordinance No. 17 of 1908).

19. Seize all hides, horns, or any remains of cattle that have died in infected areas; destroy, bury, or burn them.

20. Report to your superiors all persons who disobey these regulations, for prosecution.

21. Owners of cattle detained under the Contagious Diseases (Animals) Ordinance must supply them with food and water and pay all costs of detention, erection of isolation sheds, &c. In default the Headman should report the matter to the Government Agent, and writs will be issued by the Police Magistrate to recover the same by seizure and sale of the defaulter's property, under section 15 of Ordinance No. 25 of 1909.

22. Carcases of deer or wild pig that have died of rinderpest must be buried or burnt, and all hides and horns of animals dying of rinderpest must be destroyed.

Precis of No. 9 of 1912.—An Ordinance to consolidate and amend the Ordinances relating to the Medical Wants of Labourers in Planting Districts.

In this Ordinance, unless the context otherwise implies—

“Medical Officer” includes any district medical officer and Definitions. any officer of the Medical Department charged with duties of supervision or inspection in connection with estates.

“District Medical Officer” includes district medical assistant, visiting medical officer, and visiting apothecary.

“Estate” means any estate in which labourers are employed having ten acres of land actually cultivated in tea, rubber, coffee, cacao, cardamoms, coca, camphor, pepper, or cinchona.

"Government Agent" includes Assistant Government Agent.

"Hospital" means any Government hospital.

"Dispensary" means any Government dispensary.

"Labourer" means a labourer employed upon an estate and includes kangany and female labourer and any child or other relative of a labourer resident upon the same estate.

"Immigrant labourer" means any labourer as defined by section 2 of Ordinance No. 9 of 1909.

"Prescribed" means prescribed by rules made under this Ordinance, or by departmental rules or orders.

"Superintendent" means any person in the immediate charge of an estate.

Organization of Estates Medical Districts.

There shall be established for every medical district such hospitals and dispensaries as may be necessary for the medical wants of the estates of the district—

Duties of Medical Officers.

It shall be the duty of a district medical officer for the purposes of this Ordinance—

- | | |
|-----------------------------|--|
| Duties of medical officers. | (a) Upon the written request of a superintendent, to visit any sick labourer upon his estate. |
| | (b) To direct the removal to hospital of any such sick labourer whose removal he may consider necessary ; |
| | (c) To attend upon all such labourers who at the direction of a district medical officer or otherwise may be admitted to hospital. |

7 It shall be the duty of every medical officer (being a duly qualified medical practitioner registered under sections 12 and 13 of Ordinance No. 2 of 1905) for the purposes of this Ordinance from time to time—

- (a) To visit the estates within his district, or any other estate which he may be specially directed to visit, and to inspect the sanitary condition thereof ;
- (b) To examine the labourers on such estates for the purpose of ascertaining their condition of health, and whether they have been duly vaccinated ;
- (c) To inspect all children under the age of one year resident upon such estates, and to give directions to the superintendent for their proper care and nourishment ;
- (d) To direct the removal to hospital of any sick labourer whose removal he may consider necessary ;

- (e) To draw the attention of the superintendent to any defect in the sanitary condition of his estate, and in the condition of health of the labourers ;
- (f) If any estate has an estate hospital or dispensary, to inspect such hospital or dispensary ;
- (g) To report to the P. C. M. O. on all or any of the above matters.

8 Any person who shall wilfully obstruct any medical officer acting in the discharge of his duties shall be guilty of an offence.

Penalty for obstructing a Med. Officer.

Rights, Duties, and Obligations of Superintendents, &c.

Any superintendent shall be entitled —

- (a) To medical attendance by a district medical officer upon any sick labourer upon his estate ;
- (b) To the reception at a hospital (subject to the accommodation of the hospital) of any labourer who in the opinion of a district medical officer ought to be admitted to the hospital.

Rights, duties
and obligations
of superin-
tendents.

- (c) To the free supply from the Medical Department for the purpose of any estate hospital or dispensary of all such prescribed drugs as he may require for the medical wants of his labourers to a value not exceeding fifty cents per labourer per annum ;

- (d) To the supply at cost price from the Medical Department or from a Government dispensary of all such prescribed drugs as he may reasonably require for the medical wants of his labourers other than those authorized by the last preceding paragraph.

Sums payable
by superinten-
dent.

The following sums shall be payable by every superintendent in respect of medical services rendered under this Ordinance.

- (a) In respect of every visit to an estate for the purpose of attendance on any sick labourer or labourers, two rupees and fifty cents ;
- (b) In respect of the maintenance of a sick immigrant labourer in a hospital for each day's maintenance, thirty cents ; or such other sums as may from time to time be prescribed.

Not to exceed
sixty days.

Provided that the liability in respect of such last mentioned charge shall not extend beyond a period of sixty days.

All fees are
debts to the
Crown.

All amounts due under the last preceding section shall be a debt to the Crown recoverable from the proprietor of the estate, and shall constitute a charge upon the estate.

(1) It shall be the duty of every superintendent—

- Duties of superintendents.
- (a) To maintain the lines of his estate and their vicinity in a fair sanitary condition ;
 - (b) To inform himself of all cases of sickness on his estate, and to take such steps as he may deem best for the immediate relief of the sick ;
 - (c) To send any labourer to hospital when so required by a medical officer ;
 - (d) To send for the district medical officer in any case of serious illness or accident ;
 - (e) To inform the district medical officer within forty-eight hours of every birth and death upon the estate :

To inform the D. M. O. of births and deaths.

(f) To supply at the cost of the estate every female labourer resident upon the estate, and giving birth thereon to a child, with sufficient food and lodging for one month after the birth of such child, and to take care that the female labourer be not required to work on the estate for one month, unless the district medical officer shall report sooner that she is fit to work ;

(g) To see that all children under the age of one year resident upon the estate receive proper care and nourishment, and to comply with all directions given by a medical officer under section 7 (c).

(2) Any superintendent who shall wilfully make default in the performance of any of his duties under this section shall be guilty of an offence against this Ordinance.

(1) It shall be the duty of every kangany employed upon an estate to give information to the superintendent of every birth, death, and case of sickness in his gang.

Kanganys duty.

(2) Any kangani who shall fail so to do shall be guilty of an offence against this Ordinance.

Negligence an offence.

Recovery of Charges.

When any sum of money shall be payable—

- G. A. to recover charges.
- (a) In respect of drugs supplied under section 9 (d) ;
 - (b) In respect of medical services under section 10—
- it shall be the duty of the Government Agent to give notice in writing to the superintendent of the estate in respect of which the same is payable, requiring the payment thereof within one month after such notice.

In Default of such payment it shall be lawful for the Government Agent or any person authorized by him in writing in that behalf to seize from time to time all the crops, live stock, and implements, or any part thereof, found on the estate liable in respect of such sum, or any other article or thing whatsoever belonging to the proprietor or any of the proprietors of such estate, until the full amount due by such estate shall be recovered.

If there be no sufficient crop, live stock, or implements on such estate to realize the amount due, it shall be lawful for the Government Agent or other person authorized as aforesaid to cause the timber on the said estate to be cut, or the materials of the buildings erected thereon to be removed, and to seize the same.

At any time after thirty days from the date of seizure, unless the sum due shall be paid sooner, with the costs and charges incurred in respect of such seizure, it shall be lawful for such Government Agent or any person as aforesaid to sell the property so seized by public auction. Provided that perishable property may be sold at any time after the date of such seizure.

No seizure shall take place for any sum of money which shall have been in arrear for a period of one year.

Any property seized may be removed for safe custody, pending the sale thereof, to such place as the person directing the seizure may think fit.

In the case of the seizure of any property which cannot conveniently be removed, it shall be lawful for the person making the seizure to place and keep a person in possession thereof pending such sale.

The costs and charges of seizure and sale shall also be payable from the proceeds of the property seized, and they shall be as follows:—

- (1) For cost of proceeding to the house or land of the party in default in order to seize property, a charge not exceeding eight per centum on the amount due.
- (2) For removal of the goods seized, in case such removal takes place, a charge not exceeding eight per centum on the amount due.
- (3) For keeping the same in safe custody in case of such removal, a charge not exceeding one rupee per day.
- (4) For keeping a person in possession, if the goods seized are not removed, a charge not exceeding one rupee per day.

- (5) For the expenses of sale, where any takes place, a charge not exceeding two and a half per centum on the nett proceeds of the sale.

It shall be lawful for the Government Agent or person authorized as aforesaid to break open in the daytime any house or building for the purpose of seizing property, if he shall have affixed to a conspicuous part of such house or building three clear days previously a notice of his intention so to do.

G. A. after notice may forcibly enter.

In the event of a sale of property seized, the Government Agent at whose instance such seizure was made shall, after deducting the amount due by the defaulter, and also the cost and charges payable under section 21, restore the overplus arising from such sale, if any there be, to the owner of the property sold.

Whoever shall wilfully obstruct any person in the performance of any duty imposed upon him, or in the exercise of any authority vested in or conferred upon him, shall be guilty of an offence against this Ordinance.

Medical Wants Committee.

There shall be established a Committee, to be called the Medical Wants Committee, consisting of such members, official and unofficial, as the Governor may from time to time appoint. Provided that three of such members shall be persons whose names are submitted to the Governor by the Planters' Association of Ceylon.

The Medical Wants Committee shall advise the Governor—

Their duties.

- (a) On the requirements of labourers as regards the construction of hospitals and dispensaries ;
- (b) On the annual statement prepared under section 30, and the estimate to be framed thereon ;
- (c) On the rebates to proprietors authorized by section 27 ;
- (d) On all rules made under this Ordinance ;
- (e) Generally on all such matters relating to the administration of this Ordinance as the Committee may desire to bring to the notice of the Governor, or as the Governor may refer to it for advice.

27 When the proprietor of an estate or group of estates has at his own cost made provision to the satisfaction of the Principal Civil Medical Officer for the medical treatment of the labourers employed on such estate or group of estates, the Medical Wants Committee may at its

Rebate of fees to estates providing medical attendance.

discretion, and subject to rules made under section 32, allow to such proprietor a rebate of the whole or part of the duties paid under section 28 on the exportation of the produce of such estate or group of estates.

Financial Provisions.

28 The Legislative Council may from time to time by resolution impose duties on the exportation of tea, rubber, coffee, cacao, cardamoms; coca, camphor, pepper, and cinchona, at such rates as the Council may deem sufficient for the purpose of meeting the expenses of the administration of this Ordinance, in so far as the same are not herein otherwise provided for.

29 For the purpose of estimating the amount for which it may be necessary to make provision under the last preceding section, it shall be the duty of the Principal Civil Medical Officer to prepare annually for submission to the Legislative Council a financial statement of the expenses of the administration of this Ordinance.

30 The said statement shall contain on the debit side of the account the following expenses :

- (a) Any deficiency brought forward on the working of the account for the period of twelve months anterior to that covered by the statement.
- (b) A *pro rata* share of the actual expenditure (including salaries of staff) during the twelve months immediately preceding the date up to which the statement is made up of all hospitals in which immigrant labourers have been treated, based upon the proportion which the number of days passed by the said immigrant labourers in the said hospitals bears to the number of days passed by other patients in the same hospitals.
- (c) A *pro rata* share of the actual expenditure (including salaries of staff) during the same period of twelve months of all dispensaries at which immigrant labourers have been treated, based upon the proportion which the number of visits paid by the said immigrant labourers to the said dispensaries bears to the number of visits paid by other patients to the same dispensaries.
- (d) In the case of all hospital or dispensary buildings completed after the commencement of this Ordinance, which the Governor,

Financial
Provisions.

P. C. M. O.
to submit an
annual state-
ment of
expenses.

Statement,
how to be
prepared.

with the advice of the Medical Wants Committee, shall determine to have been primarily constructed for the accommodation of immigrant labourers, such an annual amount as would be sufficient to liquidate the cost of construction of the said buildings, together with interest at four per centum per annum on any unliquidated amount, in twenty-five equal annual instalments, until the said cost of construction is so liquidated.

- (e) In the case of all other expenditure properly chargeable to a capital account upon such hospitals and dispensaries, and all existing hospitals and dispensaries which may be from time to time declared by the Governor, with the advice of the Medical Wants Committee, to be primarily maintained for the accommodation of immigrant labourers, an annual amount calculated upon the same basis.

- (f) The cost price of all drugs supplied to superintendents under section 9 (d) during the aforesaid period of twelve months.

- (g) All miscellaneous expenses incidental to the administration of this Ordinance during the same period.

The said statement shall contain on the credit side of the account—

- (a) Any surplus brought forward on the working of the account for the period of twelve months anterior to that covered by the statement ;
- (b) The amount of all sums recovered as visiting or maintenance fees under section 10 during the twelve months preceding the date up to which the statement is made up ;
- (c) The amount of all fines recovered in respect of all offences against the Ordinance during the same period ;
- (d) The amount of all sums received as the cost price of drugs supplied to superintendents under section 9 (d) during the same period ;
- (e) The amount of the export duty collected under section 28 during the same period ;
- (f) An annual contribution out of moneys provided by the Legislative Council of an amount equal to fifteen per centum of the total expenses of the administration of this Ordinance during the same period, as shown by the debit side of the account.

Miscellaneous.

- (1) The Governor in Executive Council may make rules regulating—
- (a) The fees payable to district medical officers by superintendents and persons other than labourers engaged upon estates for medical attendance and for medicines dispensed at dispensaries ;
- (b) The management of estate hospitals and dispensaries ;
- (c) The supply of drugs to superintendents from dispensaries and from the Medical Department ;
- (d) The powers and duties of hospital visitors ;
- (e) The conditions subject to which rebates will be allowed under section 27, and the evidence which will be required in support of applications for rebate ;
- (f) The form in which, and the time within which, applications for rebate should be made ;
- (g) The manner in which such rebate shall be made, and generally on all matters connected with the allowance thereof ;
- (h) Any other matters necessary for the administration of this Ordinance that cannot be provided for by departmental rules and orders.

(2) All such rules shall be laid as soon as conveniently may be before the Legislative Council, and if a resolution is passed within forty days of their being laid before the Legislative Council praying that any rule shall be annulled, such rule shall thenceforth be void, but without prejudice to anything done thereunder.

The Legislative Council may, from time to time, by resolution amend the definition of "estate" in section 2 by the addition of any agricultural product to the list of agricultural products therein enumerated, or by the elimination of any agricultural product from the said list, and any such agricultural product shall thereupon become subject to or exempt from the imposition of duty on exportation, as the case may be, under section 28.

(1) Any person convicted of an offence under this Ordinance shall be liable to a fine not exceeding five hundred rupees.

(2) Every such offence shall be triable by a Police Magistrate, and such Magistrate shall have power to impose the full penalty provided for by this section, notwithstanding any limitation of the ordinary jurisdiction of such Magistrate.

**RULES UNDER SECTION 32 (1) OF THE MEDICAL WANTS
ORDINANCE, No. 9 of 1912.**

[Extract from the "Ceylon Government Gazette" No. 6,816
of August 4, 1916.]

"THE MEDICAL WANTS ORDINANCE, No. 9 of 1912."

It is hereby notified that His Excellency the Governor in Executive Council has been pleased to revoke rules Nos. 1, 2, and 3 dated February 20, 1913, and published in the *Government Gazette* of the 21st idem, and to substitute the following rules under section 32 (1) of "The Medical Wants Ordinance, No. 9 of 1912."

Colonial Secretary's Office,
Colombo, July 31, 1916.

By His Excellency's command,
R. E. STUBBS,
Colonial Secretary.

Rules.

A.—Fees payable to District Medical Officers.

1. By Superintendents and persons other than labourers engaged upon estates for medical attendance and for medicines dispensed at dispensaries :—

- (a) Visit and medical attendance at patient's own place of residence for themselves, their wives, and children: Rs. 10.50 for the first visit, and Rs. 7.50 for subsequent visits (in same illness).
- (b) For midwifery: Rs. 125, to include three subsequent visits.
- (c) Vaccination: Rs. 15.
- (d) Medical attendance at doctor's house or dispensary, or for prescription by letter: Rs. 3.75.

2. By Assistant Superintendents :—

- (a) Visit and medical attendance at patient's own place of residence for themselves, their wives, and children: First visit, Rs. 7.50; subsequent visits, Rs. 5.25 (in same illness).
- (b) For midwifery: Rs. 75, to include three subsequent visits.
- (c) Vaccination: Rs. 10.
- (d) Medical attendance at doctor's house or dispensary, or for prescription by letter: Rs. 2.50.

2½. If the District Medical Officer be a Visiting Apothecary, the following shall be the fees payable instead of those in rules 1 and 2 above:

- (a) Visit and medical attendance at patient's own place of residence, for themselves, their wives, and children: Rs. 3 for first visit, and Rs. 2 for each subsequent visit (in same illness).
- (b) For midwifery: Rs. 20, to include three subsequent visits.

(c) Vaccination: Rs. 2, and the cost of the lymph if at patient's own residence.

(d) Medical attendance at dispensary, or for prescription by letter: Re. 1.

3. By clerks, conductors, teamakers, carpenters, masons, kanakapillais, storekeepers, chauffeurs, domestic servants, and employés of similar status:—

(a) Visit and medical attendance at patient's own place of residence for themselves, their wives, and children: Rs. 3 for each visit.

(b) For midwifery: Rs. 15.

(c) Vaccination: Rs. 3, or free at the dispensary.

(d) Medical attendance at doctor's house or dispensary, or for prescription by letter: Re. 1.

3½. If the District Medical Officer be a Visiting Apothecary, the following shall be the fees payable instead of those in rule 3 above:—

(a) Visit and medical attendance at patient's own place of residence for themselves, their wives, and children: Rs. 2 for each visit.

(b) For midwifery: Rs. 10.

(c) Vaccination: Rs. 2, and the cost of the lymph if at patient's own place of residence, otherwise free at dispensary.

(d) Medical attendance at dispensary, or for prescription by letter: Re. 1.

Note.—The scale of fees for Medical Officers includes transport, but in the case of Visiting Apothecaries mileage should be paid at the rate of 20 cents per mile each way, if transport is not found by the patient.

4. In the absence of an efficient private dispensary or drug store, prescriptions for the above 1, 2, and 3 may be dispensed at a Government dispensary at the same rate as for Government servants, viz. :—

| | Cents. |
|--|--------|
| Mixtures and draughts, per ounce | 5 |
| Lotions, injections, gargles, per ounce | 2 |
| Pills and powders, each | 2 |
| Ointment, per ounce | 10 |
| Liniment, per ounce | 10 |
| Blisters, per square inch | 2 |
| Suppositories, each | 15 |
| " Drops," per drachm | 10 |

Concentrated mixtures and expensive drugs are to be charged for at cost price.

C.—The Supply of Drugs to Superintendents from Dispensaries and from the Medical Department.

5. Superintendents may obtain such drugs as those prescribed in Appendix A at cost price from Government dispensaries to the total value of Rs. 5 for cash with order, provided that no quantity of any one drug of the value of more than Re. 1 shall be supplied at any one time; and from the Civil Medical Stores, Colombo, to any amount on application to the Superintendent on Medical Form 159 accompanied by a remittance.

6. Superintendents of estates having a dispensary with a qualified apothecary may have such prescribed drugs free of payment to the extent of 50 cents worth per head of the estate labour population per annum.

7. The free drugs supplied to estate dispensaries by Government are for the use of estate labourers exclusively, and shall not be put to any other use whatever.

8. In requisitioning for free drugs for an estate dispensary, Superintendents of estates must confine themselves to the list of drugs published in appendix A.

9. The half-yearly requisitions for free drugs, to be despatched within a month, must reach the office of the Principal Civil Medical Officer on or before the dates given below :—

For estates in the Central Province on January 10 and June 10.

For estates in the Uva and Southern Provinces on March 1 and August 1.

For estates in the Sabaragamuwa, and North-Western Province on April 1 and October 1.

For estates in the Western Province on May 1 and November 1.

Drugs required between the half-yearly requisitions shall be applied for by an intermediate requisition (Medical Form 166.)

10. Quinine and tincture of opium shall be applied for separately from other drugs, on Medical Form 166 for quinine, and on Opium Form No. 1 for tincture of opium.

11. All columns of requisition forms must be accurately filled up. The "Remaining" column must show the actual amount in stock at date of requisition. Requisitions shall be signed by the Superintendent of the estate and be accompanied by a certificate as in Appendix B.

D.—The Powers and Duties of Hospital Visitors.

12. Hospitals will be open daily at any time between the hours of 8 A.M. and 6 P.M. for the visits of Official and Unofficial Hospital Visitors.

Powers and duties of Hospital visitors.

13. The Medical Officer in charge of the hospital or, in his absence the next senior officer of the hospital staff shall accompany the Visitor on, his inspection.

14. It is desirable that Unofficial Visitors should ascertain whether the patients have any complaints, and if so, that they should inquire into them and record particulars in the Visitors' Book.

15. The quality and quantity of the food supplied to the patients and the cleanliness and tidiness of the hospital and its surroundings are important subjects for inspection.

16. The perusal of the official records does not necessarily come within the scope of the Unofficial Visitor's inspection.

17. Visitors are not competent to give orders, and shall avoid offering criticism, except in the form of remarks and observations recorded in the Visitors' Inspection Book, which will be submitted to them, containing questions, to which it is desirable that full answers should be recorded.

E.—Rules framed under Section 32 (1) (c) for the Guidance of Estate Proprietors desirous of qualifying for Rebate under Section 27.

18. New estate hospitals shall be erected in open clearings as far removed as possible from jungle and swamp. Where possible a space of not less than 100 feet all round shall be kept clear of jungle, and only ornamental cultivation should be permitted within that area.

Rules regarding rebates.

19. The accommodation provided shall be sufficient for the requirements of the estate, as approved by the Inspecting Officer and the Medical Wants Committee, but separate wards must be provided for bowel diseases. In the event of serious overcrowding occurring in any estate hospital, the erection of temporary accommodation may be permitted.

20. Separate accommodation shall be provided for males and females.

21. Estate hospitals, dispensaries and latrines constructed subsequent to these rules coming into force shall be in accordance with type plans approved by the Medical Wants Committee. Copies of such plans can be obtained on application to the Secretary, Medical Wants Committee, Colonial Secretary's Office, Colombo.

22. A bed shall be provided for each patient, and the minimum superficial area allowed for each bed in ordinary wards shall be 60 square feet, and 90 square feet in wards for infectious or dirty cases. The cubic space shall not be less than 900 and 1,200 feet respectively per bed.

23. Kitchen, mortuary, earth-closet, and bathrooms shall be erected for each estate hospital at a suitable distance from the wards.

24. A dispensary and quarters for the medical staff and servants shall be provided at each estate hospital.

25. The beds for the patients shall consist of three separate hard wood planks each 10 inches wide, and of uniform thickness, resting on iron trestles.

26. Efficient mosquito curtains or gnat-proofing in malarious districts shall be provided.

27. Two suits of estate hospital clothing and one pillow shall be provided per bed, and cumblies or blankets in the proportion of three for every two beds.

28. Bed pans and other utensils shall be provided for patients unable to leave the wards. Enamelled iron chamber pots with covers shall be provided for all diarrhoea and dysentery cases. The excreta of all infectious bowel diseases shall be disinfected before being disposed of.

29. All articles of equipment shall be cleansed as often as may be necessary.

30. The scale of diets and the quality shall be those set out in Appendix C, but extra articles of diet and medical comforts shall be provided as ordered by the Medical Officers in charge of the estate hospital.

31. The Medicines specified in appendix A shall be kept in stock in each estate hospital with the necessary apparatus for compounding and dispensing.

32. The instruments and appliances provided shall be in accordance with modern requirements, subject to the approval of the Principal Civil Medical Officer.

33. The number of male and female attendants shall not be in a less proportion than one for every ward of twelve beds, and dhobies and scavengers shall be employed in sufficient numbers.

34. The officer in charge of an estate hospital shall live in the immediate vicinity of the building; subject to supervision, he shall have the immediate care of all estate hospital patients, and shall see that all treatment ordered is carried out.

35. The officer in charge shall see that the estate hospital is kept clean and in good order. Each ward shall be swept twice a day, and the floor washed once a week at least. Latrines shall be cleansed twice daily, and their contents buried or otherwise disposed of in a satisfactory manner.

36. The officer in charge shall see that the supply of medicines is sufficient, that poisons are kept under lock and key in a separate place, and that the instruments and general equipment of the hospital are in

order. He shall be responsible for the keeping up to date of all hospital documents. He shall indent on the Superintendent for the estate hospital food supplies and all extras.

37. An attendance Register of the staff shall be kept in every estate hospital.

38. The Admission and Discharge Book, Temperature Charts, and Bed-head Tickets shall be in the forms used in hospitals. Separate records shall be kept of outpatients treated, giving date, name and disease.

39. Monthly and annual returns shall be furnished to the Provincial Surgeon on the prescribed forms. The returns for each month shall reach the Provincial Surgeon not later than the 10th of the following month, and the annual returns not later than January 20.

40. Every estate hospital must be inspected from time to time by the Principal Civil Medical Officer, Provincial Surgeon, or some other duly qualified Inspecting Officer not below the rank of District Medical Officer.

41. There must be kept in every estate hospital a Visitors' Book, in which the Inspecting Officers must record their visits with any remarks regarding the hospital.

42. The Superintendent of the estate to which the estate hospital belongs shall be responsible that any recommendation, criticism, or complaint of any of the Inspecting Officers mentioned in rule 40 shall receive prompt attention.

43. A sufficient supply of potable water shall be provided for the estate hospital, and the Medical Officer or dispenser shall see that there is no chance of contamination of the supply.

F and G.—The Form in which and the time within which Applications for Rebate should be made; the manner in which such Rebates shall be made; and generally on all Matters connected with the allowance thereof.

44. Applications for rebates shall be made in writing on the prescribed form (see Appendix D) within six weeks of the close of the financial year and be addressed to the Secretary, Medical Wants Committee, Colonial Secretary's Office, Colombo. Any claim made after the prescribed time shall be considered to have lapsed, and will not be entertained.

45. The Medical Wants Committee on receipt of such application shall refer the application to the Principal Civil Medical Officer, who shall direct that the estate hospital, in respect of which a rebate is claimed, be specially inspected for report to the Committee.

46. At the meeting of the Committee at which such application is brought up for consideration the Principal Civil Medical Officer shall lay before the Committee the report above called for and any available returns relating to estate hospitals in respect of which a rebate is claimed.

H.—Any other Matters necessary for the Administration of this Ordinance that cannot be provided for by Departmental Rules and Orders.

47. It shall be the duty of the Superintendent of every estate to provide a sufficient supply of potable water for his labour force. Such supply shall be free from contamination: and if in the opinion of the Principal Civil Medical Officer the supply is deficient, inferior, or open to contamination, it shall be the duty of the Superintendent to provide a proper supply to the satisfaction of the Principal Civil Medical Officer. Where wells are used, they must be covered and supplied with a pump, and be surrounded by a cement platform. All water pipes must be made of iron. Bathing places, where possible, shall be paved.

48. It shall be the duty of every Superintendent to provide proper dwelling accommodation for his labour force and sufficient clearing around the lines and proper drainage to the satisfaction of the Principal Civil Medical Officer.

49. An estate dispenser shall request the Superintendent to send for the District Medical Officer in serious cases, and for women in unduly prolonged labour.

50. An estate dispenser shall keep a register of patients treated, and a book in which he shall record all prescriptions compounded by him. He shall submit a monthly return to the Provincial Surgeon of the Province and Medical Form 5A.

51. In the event of any Superintendent feeling aggrieved at any order or direction issued under the foregoing rules, he shall have the right to appeal to the Governor in Executive Council.

MEDICAL INFORMATION

313

APPENDIX C. (Rule 30.)

| Departmental Ref. No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 12 | 13 | 13a | 15 |
|------------------------------------|------|--------|-------------------|--------------|------------|---------------|------|-----------|---------------------|-------|-----------------|-------------------|-------|
| NAME OF DIET. | Beef | Mutton | Chicken (Dressed) | Fish (Fresh) | Fish (Dry) | Fish (Salted) | Eggs | Vegetable | Milk (Fresh, Cows') | Bread | Rice (Ordinary) | Rice (Muttusamba) | Risks |
| For Nurses. | oz. | oz. | oz. | oz. | oz. | oz. | | oz. | oz. | oz. | oz. | oz. | oz. |
| 1 Beef | 16 | — | — | — | — | — | 2 | 6 | 5 | 16 | — | 6 | — |
| 2 Mutton | — | 12 | — | — | — | — | — | 6 | 5 | 16 | — | 6 | — |
| 3 Fish and Chicken | — | — | 6† | 8† | — | — | 2 | 6 | 5 | 16 | — | 6 | — |
| 4 Low | — | — | — | — | — | — | — | — | 30 | 8 | — | — | — |
| For Natives. | | | | | | | | | | | | | |
| 5 Beef | 10 | — | — | — | — | — | — | 6 | — | — | 16 | — | — |
| 6 Mutton | — | 8 | — | — | — | — | — | 6 | — | — | 16 | — | — |
| 7 Chicken | — | — | 8 | — | — | — | — | 6 | — | — | 16 | — | — |
| 8 Fish (Fresh) | — | — | — | 6 | — | — | — | 6 | — | — | 16 | — | — |
| 9 Fish (Dry) | — | — | — | — | 6 | — | — | 6 | — | — | 16 | — | — |
| 10 Fish (Salted) | — | — | — | — | — | 6 | — | 6 | — | — | 16 | — | — |
| 11 Egg | — | — | — | — | — | — | 4 | 6 | — | — | 16 | — | — |
| 12 Vegetable | — | — | — | — | — | — | — | 8 | — | — | 16 | — | — |
| 13 Milk | — | — | — | — | — | — | — | — | 30 | 8 | — | — | — |
| 14 Bread | — | — | — | — | — | — | — | — | 24 | 16 | — | — | — |
| 15 Rice | — | — | — | — | — | — | — | — | 24 | 2 | 8 | — | — |
| 16 Rusk | — | — | — | — | — | — | — | — | 24 | — | — | — | 8 |
| 17 Sago | — | — | — | — | — | — | — | — | 24 | 8 | — | — | — |
| 18 Arrowroot | — | — | — | — | — | — | — | — | 24 | 8 | — | — | — |
| 19 Corn Flour | — | — | — | — | — | — | — | — | 24 | 8 | — | — | — |
| For Europeans and Burghers. | | | | | | | | | | | | | |
| 20 Beef | 12 | — | — | — | — | — | 2 | 6 | 5 | 12 | 6 | — | — |
| 21 Mutton | — | 12 | — | — | — | — | 2 | 6 | 5 | 12 | 6 | — | — |
| 22 Chicken | — | — | 6 | — | — | — | 2 | 6 | 5 | 12 | 6 | — | — |
| 23 Fish (Fresh) | — | — | — | 8 | — | — | 2 | 6 | 5 | 12 | 6 | — | — |
| 24 Fish (Dry) | — | — | — | — | 8 | — | 2 | 6 | 5 | 12 | 6 | — | — |
| 25 Milk | — | — | — | — | — | — | — | — | 36 | 8 | — | — | — |
| 26 Rusk | — | — | — | — | — | — | — | — | 24 | — | — | — | 8 |
| 27 Sago | — | — | — | — | — | — | — | — | 24 | 8 | — | — | — |
| 28 Arrowroot | — | — | — | — | — | — | — | — | 24 | 8 | — | — | — |
| 29 Corn Flour | — | — | — | — | — | — | — | — | 24 | 8 | — | — | — |

† Or 8 oz. Fish (fresh.)

(APPENDIX D. Rule 44.)

Claim for Rebate of Export Duties imposed under Section 28 of the Medical
Wants Ordinance, No. 9 of 1912, in respect of the Government
Financial Year ended June 30, 191—.

(N. B.—To be filled in by the Superintendent of the estate)

1. Name of Estate : _____
2. Area : _____
3. District : _____
4. Owner : _____
5. Agents or Secretaries in Colombo : _____
6. For the last Calendar Year :

| | Tea. | Rubber. | Coffee. | Cacao. | Carda- moma. | Camphor. | Coca. | Pepper. | Cinchona. |
|---|------|---------|---------|--------|-----------------|----------|-------|---------|-----------|
| Acreage under cultivation ... | | | | | | | | | |
| | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. |
| Exported ... | | | | | | | | | |
| Sold in Colombo ... | | | | | | | | | |
| Total... | | | | | | | | | |
| Amount of Duty payable on Export and Sales ... | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. |

Note.—The certificate of the Proprietor or of the Agents and Secretaries will be required in support of the figures stated.

7. Total amount of duty paid on all produce ... Rs.
8. Amount of rebate claimed Rs.

(Signature of Superintendent or Owner of the Estate.)

Date : , 191

**SCALE OF FEES PAYABLE TO MEDICAL OFFICERS IN THE DEPARTMENT OF
GOVERNMENT FOR JUDICIAL WORK.**

| | | |
|---|----|-------|
| I.—For attendance and examination at an inquest whereat no postmortem examination has been made by the Medical Officer: Provided that he be not the same officer who attended the deceased at his death, or at any time after his receiving the injury by which he died | | R. c. |
| ... .. | 10 | 50 |
| II.—For making a postmortem examination, making report, and giving evidence thereon | | 21 00 |
| III.—In addition to the above fees, the Medical Officer shall be entitled to travelling expenses at the rate of 37½ cents a mile, both ways, for every mile he has travelled from his place of residence, or to coach or railway fare in lieu thereof for such distance as either coach or railway is available. Mileage of fifty cents may be charged in the Central Province. | | |
| IV.—For making a complete analysis of the contents of the stomach or intestines or any of the internal organs, and drawing up a report thereon, and giving evidence before the Inquirer into deaths if so desired | | 10 50 |
| V.—For the examination (physical, chemical, and microscopical) of any substance or instrument sent to the Medical Officer, and for drawing up a report thereon, or giving evidence before the Inquirer into Deaths if required... | | 10 50 |
| VI.—For the examination of such cases of injury as shall be sent to the Medical Officers by Justices of the Peace for examination and report, and for cases of an exceptional nature which do not come within the definition of grievous hurt | | 5 00 |

Under Rules I., IV., V., and VI., for examination at an inquest where there are more than one subject, for analysis of several substance, etc., and for examination of more than one injured person in one case, the Medical Officer shall be entitled to only one fee.

An Ordinance to prevent the spread of Diseases among Labourers

No. 10 of 1912.

In this Ordinance—

"Disease" means any disease which may from time to time be proclaimed by the Governor in Executive Council under

Definition. this Ordinance.

"District medical officer" means a duly qualified medical practitioner registered under section 12 and 13 of Ordinance No. 2 of 1905, and attached to a Government hospital or dispensary.

"Superintendent" means any person in the immediate charge of any estate.

"Prescribed" means prescribed by rules made under this Ordinance.

"Labourer" includes kangany and female labourer, and any child or other relative of any labourer resident upon the same estate.

To apply to all estates with ten acres cultivated.

3 This Ordinance shall apply to all agricultural estates of which ten acres or more are cultivated.

Provided that in any case in which a provincial surgeon is satisfied that any disease in fact prevails upon an agricultural estate with a lesser area of cultivation, he may, by written notice under his hand addressed to the owner or superintendent of the estate; direct that the provisions of this Ordinance shall apply to such estate, and upon the service of such notice upon the owner or superintendent the said provisions shall apply accordingly.

Provincial surgeon to give notices.

Provided further that in any case in which the Governor in Executive Council is satisfied that the labourers employed by any Government Department or by any employer of labour other than a superintendent are housed under such conditions that the provisions of this Ordinance are capable of application to their residential quarters, he may, by Order in Council notified in the "Government Gazette," apply the provisions of this Ordinance to the residential quarters of such labourers with such modifications as may be necessary for the purpose.

Governor may apply regulations to residential quarters.

4 Where any superintendent has reason to believe that any disease prevails among the resident labourers of his estate, he shall give notice in writing in the prescribed manner to the district medical officer and request his assistance in the treatment of the disease.

Superintendent to give notice of disease.

5 Where a district medical officer receives a notice under the last preceding section, or where he has otherwise reason to believe that any disease is prevalent upon an estate, he may enter upon the estate and inspect all the labourers and the sanitary condition of the cooly lines of the estate, and give such directions as he may consider necessary for the treatment of the disease.

D. M. O. may inspect an estate.

6 In any such case the district medical officer may—

- D. M. O. may require certain treatment which superintendent must carry out.
- (a) Require any labourer to be removed to hospital ;
 - (b) Require the superintendent to treat the labourers in the prescribed manner in such convenient batches as he may indicate ;
 - (c) By notice in writing require the superintendent to treat in the prescribed manner all the labourers of the estate—

and it shall be the duty of the superintendent to carry out all such requirements.

- 7 (1) Where the Principal Civil Medical Officer is satisfied that any disease prevails upon an estate to such an extent or under such conditions that it cannot be effectively treated under the provision of the last preceding section, he may direct a medical officer of his department to inspect the estate—
- P. C. M. O. may direct an inspection and issue instructions.

(2) In any such case the medical officer so authorized shall enter upon the estate and inspect the labourers, cooly lines, latrines, bathing places, and water supply, and to do all things necessary to enable him to report to the Principal Civil Medical Officer as to the measures to be taken for the treatment of the disease upon the estate.

(3) The Principal Civil Medical Officer upon receiving the said report may thereupon, by a notice in writing, require the superintendent to carry out such measures, not being measures provided for by section 9, as in the opinion of the Principal Civil Medical Officer are necessary for the purpose aforesaid, and it shall thereupon become the duty of the superintendent to carry out all such measures accordingly.

Provided that where the expense involved by any such notice exceeds an amount of two rupees per cultivated acre of the estate, an appeal shall lie to the Governor in Executive Council.

- 8 (1) If within three months from the date of the receipt of the said notice the superintendent shall not have carried out the measures required by the said notice to the satisfaction of the Principal Civil Medical Officer, it shall be lawful for the Governor, on receiving a report to that effect from the Principal Civil Medical Officer, to cause the said measures to be effectively carried out upon the estate.
- Superintendent to carry out instructions, or P. C. M. O. does so.

(2) The cost of any such measures so carried out shall be a debt to the Crown recoverable from the owner of the estate, and shall constitute a charge on the estate.

Cost recoverable from estate.

(3) The sum so due shall be recoverable in the manner prescribed by Chapter V. of the Medical Wants Ordinance, No. 9 of 1912.

9 (1) In any case in which any medical officer charged with the duty of the inspection of estates shall report that any set of cooly lines is constructed in such a position or under such conditions that any disease prevalent or liable to become prevalent therein cannot be effectively controlled, and that the said set of cooly lines is not capable of adaptation or its effective control, it shall be lawful for the Governor to condemn such set of cooly lines, and to order its reconstruction to his satisfaction upon such site and under such conditions as shall be suitable for the purpose of the prevention of the spread of the disease, and it shall be the duty of the superintendent to carry out such order.

(2) If within three months of the communication of such order to the superintendent, or such further time as may be directed in the order, the superintendent shall not have complied therewith, it shall be lawful for the Governor to carry out the measures directed by such order, and the expenses thereof shall be a debt to the Crown recoverable from the owner of the estate, and shall constitute a charge upon the estate.

(3) The sum so due shall be recoverable in the manner prescribed by Chapter V. of the Medical Wants Ordinance, No. 9 of 1912.

10 (1) A superintendent may require any labourer employed upon an estate, whether resident upon the estate or otherwise to submit to such treatment as may be prescribed or otherwise lawfully directed under this Ordinance.

Labourer to submit to treatment lawfully prescribed by Superintendent.

(2) It shall be the duty of every such labourer, when so required by the superintendent, to attend at all reasonable times and places and to submit to such treatment.

11 It shall be the duty of a superintendent to notify the district medical officer if he has reason to believe that any disease prevails in the immediate vicinity of his estate.

Duty of Superintendent to notify D.M.O. of prevailing disease.

12 (1) The Principal Civil Medical Officer, with the approval of the Governor in Executive Council, may make rules for the whole Colony, or for any portion of the Colony, for the treatment of diseases under this Ordinance, and for the sanitation of cooly lines with a view to the prevention of the spread of diseases, and in particular for the following purposes :

P. C. M. O. may make rules.

- (a) For the location of new cooly lines.
- (b) For the provision and regulation of latrines.
- (c) For the daily removal and disposition of excreta.
- (d) For the provision of a surrounding area round each set of cooly lines clear of vegetation.

Effect of such rules.

(e) For the drainage of cooly lines and their surrounding area.

(f) For the proper construction and drainage of bathing places.

(g) For the provision of water supply.

(2) All such rules shall be laid as soon as conveniently may be before the Legislative Council, and if a resolution is passed within forty days of their being laid before the Legislative Council praying that any rule shall be annulled, such rule shall thenceforth be void, but without prejudice to anything done thereunder.

If rules annulled action already taken is ratified.

Medical Wants Committee to advise.

13 There shall be submitted to the Medical Wants Committee for consideration and advice all rules proposed to be made under the Ordinance.

Default in carrying out Ordinance.

14 (1) Any person who without reasonable excuse the proof whereof shall lie upon such person, shall—

(a) Make default in the performance of any obligation imposed upon him by this Ordinance, or any rule or order made under this Ordinance ;

(b) Wilfully obstruct any medical officer or any person lawfully acting under his direction in discharge of the duties of such medical officer under this Ordinance, or any rule or order made under this Ordinance—

How punishable.

shall be guilty of an offence, and liable to a fine not exceeding five hundred rupees, or to imprisonment of either description not exceeding one month.

(2) Such fine shall be recoverable before a Police Magistrate, notwithstanding any limitation of his ordinary jurisdiction.

Notes to Rules made under Section 12 of "The Diseases (Labourers) Ordinance, No. 10 of 1912."

Rule 1.—When possible skilled advice from the Civil Medical Department should be obtained before finally selecting a site for new lines.

A space of at least 100 feet where possible should be kept clear of jungle immediately around lines.

Rule 2.—Where dry-earth latrines are used they should be of one of the two following types :—

(1) *Trench.*—1½ ft. wide, 1 ft. deep, and of convenient length. Excrement to be covered up daily.

(2) *Bucket.*—There should be provision for one bucket for every ten labourers, with a sufficient scavenging and latrine staff.

Rule 5.—No water should be stored in lines except such as is stored in properly constructed mosquito-proof vessels.

[Extract from the "Ceylon Government Gazette" No. 6,834 of November 10, 1916.]

"The Diseases (Labourers) Ordinance, No. 10 of 1912."

It is hereby notified that the following rules have been made by the Principal Civil Medical Officer, with the approval of the Governor in Executive Council, under section 12 (1) of the above-mentioned Ordinance, for the whole Colony, and are published for general information.

By His Excellency's command,
Colonial Secretary's Office, R. E. STUBBS,
Colombo, November 6, 1916. Colonial Secretary.

Rules Referred to.

1. On every estate sufficient latrine accommodation for all the employés thereon shall be provided to the satisfaction of the Principal Civil Medical Officer, or any officer appointed by him for the purpose of these rules (hereinafter referred to as "the appointed officer"). One compartment shall be provided for every 15 adult employés. Each child under 12 years shall count as half an adult. Separate accommodation shall be provided for men and women.

In any case where the Principal Civil Medical Officer shall, by notice in writing under his hand, call upon the Superintendent of an estate to provide latrine accommodation, such accommodation shall be provided within such time, not being less than two months, as is specified in the notice. In all other cases sufficient latrine accommodation shall be provided within a period of twelve months from the date of publication of these rules.

2. The type of latrine installed shall be in every case approved by the Principal Civil Medical Officer or the appointed officer.

3. No pit, trench, or other latrine shall be constructed or kept in such a position or in such a manner as shall, in the opinion of the Principal Civil Medical Officer or the appointed officer, cause it to be likely to be or become a nuisance or dangerous to the health of any person or persons residing or employed in the neighbourhood.

4. Single latrines of a type approved by the Principal Civil Medical Officer or the appointed officer shall be erected at convenient places throughout the estate when, in the opinion of the Principal Civil Medical Officer or the appointed officer, it is deemed advisable to do so in the interests of the health of the employés.

5. Every latrine shall be at all times kept in a clean and sanitary state and in a good state of repair, and the Superintendent shall cause to be carried out, within a reasonable period, any recommendations made by the Principal Civil Medical Officer or the appointed officer to abate any nuisance arising from the faulty condition or control of any latrine.

6. Provision shall be made for the final disposal of night soil in such manner and place as shall, in the opinion of the Principal Civil Medical Officer or the appointed officer, render it unlikely to constitute a nuisance or prove dangerous to the health of any person or persons residing or working in the neighbourhood.

7. It shall be the duty of the Superintendent of the estate to take all measures necessary to secure the effective operation of these rules.

Note.—Type plans with explanatory note may be had on application to the Principal Civil Medical Officer.

[Extract from the "Ceylon Government Gazette" No. 6,571 of July 11, 1913.]

"The Diseases (Labourers) Ordinance, No. 10 of 1912."

It is hereby notified that the following rules under section 12 of "The Diseases (Labourers) Ordinance, No. 10 of 1912," applicable to the whole Colony, have been made by the Principal Civil Medical Officer, with the approval of His Excellency the Officer Administering the Government in Executive Council.

| | |
|------------------------------|------------------------------|
| | By His Excellency's command, |
| Colonial Secretary's Office, | L. W. BOOTH, |
| Colombo, July 9, 1913. | Acting Colonial Secretary. |

Rules under Section 12 of "The Diseases (Labourers) Ordinance, No. 10 of 1912," applicable to the whole Colony, made by the Principal Civil Medical Officer, with the approval of the Officer Administering the Government in Executive Council.

1. Permanent lines shall be as far removed as possible from jungle and swamps. They shall be built on high ground on a dry site with efficient drainage; they shall not be situated near villages or insanitary surroundings. They shall not be situated in such close proximity to existing lines as to obstruct light and the free circulation of air.

2. Latrine buildings shall be of impermeable material throughout and properly drained. The contents of the buckets shall be regularly disposed of either by burning or burial in shallow trenches. Latrines shall be so situated as not to be likely to contaminate water supplies or to be a nuisance to the occupants of buildings.

3. A sufficient number of sweepers shall be provided on each estate to keep the lines and their surroundings clean, to bury or burn all excreta or refuse, and to keep the drains swept at least once a day.

4. In malarious districts travellers' palms, pineapples, plantains, or cultivation liable to favour the breeding of mosquitoes shall not be allowed near the lines. Pigs, goats, and cattle shall not be kept in any portion of the line buildings.

5. All lines shall be provided with drains to carry off the rain water. Such drains shall be constructed of stone, of brick rendered in cement, or of cement concrete. They shall have sufficient slope to carry the water well away from the lines, so that no swamps or stagnant pools are left. The immediate vicinity of the lines shall be on a lower level than the floor of the buildings and shall slope downwards from them, and all swamps or pools in the vicinity of lines shall be drained or filled in.

6. On all estates proper bathing places shall be provided for the use of labourers at spouts, pumps, wells, or riversides where possible, to consist of a stone or cement platform, with a properly constructed run-off drain.

7. It shall be the duty of the superintendent of every estate to provide a sufficient supply of potable water for his labour force; such supply shall be free from contamination. If wells are provided, they shall be covered, and be faced or pointed in cement for 10 feet from the surface of the ground, to prevent contamination. All water pipes shall be made of iron. Wells must have parapet walls, and be surrounded by a platform of stone, brick cement rendered, or cement concrete, 4 feet wide, and a peripheral drain to carry off waste water.

Extracts from Regulations of the Vaccine Department.

(October, 1912.)

The duties of the different persons named in the Ordinance No. 20 of 1886, or employed in the Vaccine Service, are here briefly given:—

- (i.) The Government Agent of the Province, in conjunction with the Principal Civil Medical Officer and the Superintendent of Vaccination, divides the district into convenient divisions, and appoints places for vaccination. He also gives, or causes headmen to give, due notice to the

G. A. and P.
C.M.O. divide
district con-
veniently.

people of the places where, and days and hours when, the Vaccinator will attend to vaccinate, and also of the days and hours when the latter will attend to inspect the progress of vaccination in the persons vaccinated.

(ii.) Every unvaccinated adult is bound to present himself at the vaccine station nearest to his residence at the appointed day and hour.

(iii.) Every parent or guardian is obliged to present any unvaccinated child who may be within the ages of three months and twelve years under his care, at the appointed place, day, and hour.

(iv.) The vaccinated adult or child must attend at the same place at the same hour on the same day in the week following vaccination, for the purpose of inspection.

(v.) All persons living in the lines on any estate, whether vaccinated or not, are bound to attend at the place and hour mentioned in the notice.

(vi.) Re-vaccination is compulsory when an adult or child resides in a house where there is a smallpox patient.

(vii.) The vaccinator is bound to vaccinate all adults or children presenting themselves at the appointed place, and it is his duty, in case of successful vaccination, to deliver a certificate under his hand according to Form A. But when the adult or child is in an unfit state to be vaccinated,

he shall give a certificate according to Form B, which will last for the period stated therein, to be renewed at the end of that period if need be.

N. B.—At the end of the time allowed the adult or child is to attend for vaccination at the Government dispensary nearest his residence when within ten miles; and if still unfit to do so, a fresh certificate must be obtained.

(xi.) The headmen, under clause 17 of the Ordinance, are bound to provide the vaccinators, etc., whenever called upon to do so, with lists of adults or children to be vaccinated, i.e.; of all unvaccinated persons within their respective districts.

10. Whenever the Medical Officer is not satisfied with the work performed by a vaccinator he shall at once call for an explanation in writing, and forward it to the Superintendent of Vaccination of the Province with his own remarks.

11. The following points shall be noted on inspection :—

- Points to be noted on inspection.
- (1) Whether the lymph used by the vaccinators is genuine calf lymph.
 - (2) Whether the vaccinators operate regularly on the stated days and at the places and hours appointed.
 - (3) Whether the results are accurately recorded, and whether the failures exceed ten per cent. of the total operations, and if so, why.

Careful and universal vaccination necessary.

17. It cannot be impressed too often upon the people that it is only by a careful and universal performance of re-vaccination that we can ensure the most complete effect of vaccination in permanently decreasing epidemics of smallpox.

Vaccinator to always have fresh lymph.

The vaccinator shall always keep himself provided with a supply of fresh lymph.

Vaccinators may not solicit gratifications.

10. Vaccinators are forbidden to ask for or accept any money or other gratification from any one, unless specially authorized in writing by the Superintendent of Vaccination.

Festival days not to be selected for vaccinating day.

21. In making out programmes, vaccination work is not to be fixed for any of the *well-known native festival days*. When first or second visits would fall on any such festival days the vaccination is to be fixed for the usual non-vaccination days (Monday or Saturday) next before or after such festival days.

Re-vaccination of non contacts not obligatory.

Except in houses where there are cases of smallpox, re-vaccination is not obligatory, and is not to be done unless the adult or parent consents.

Re-vaccination defined.

24. *Re-vaccination* means the vaccination of a person who has the marks of previous *successful* vaccination. The vaccinating again of a person who was vaccinated before, but has either no marks or only unsatisfactory marks is *primary vaccination and not re-vaccination*.

Vaccinators are directed—

Prosecution for non-vaccination.

(1) To make it known that in future a considerable number of those *adults* who fail to cause themselves to be vaccinated will be prosecuted.

Quinine to be distributed.

(3) Each vaccinator will keep himself supplied from the Medical Officer of his division with a sufficient stock of 5-grain quinine powders (which he can carry in his pockets).

(4) *Should fever be prevalent* at any vaccine station, he will on his arrival there let it be known that then, and

on the next dates appointed in the programme for him to visit his vaccine station, he will issue quinine powders free to all who come to him or send to him for the same, and he is directed to do so. He is to issue three powders for each sick person.

68. The following instructions are to be attended to by a Vaccinator—

Instructions to
vaccinators.

(1) Never perform the operation of vaccinating in a hurried or imperfect or careless manner.

(2) The operation, except when smallpox is prevailing, should not be performed in the following cases :—

Exemption
from vaccina-
tion.

(a) When the child is under three months old, feeble, sick, or sickly.

(b) During the periods of dentition or of weaning.

(c) When there has been recent exposure to the infection of measles or scarlatina, or when erysipelas is prevailing in or about the place of residence.

(d) In the case of a female when she is pregnant.

N.B.—Even in these cases, however, vaccination should be carried on where there is any danger of an epidemic of smallpox.

69. The dangers of vaccination are :—

Dangers of
vaccination.

(a) The occurrence of erysipelas.

(b) High fever after the operation, making a child very ill.

(c) Inflammatory swelling of the glands under the arm.

(d) The transmission of other diseases.

How avoidable. N.B.—All these dangers can be avoided by careful vaccination and after-treatment.

70. The chief causes of failure in vaccination are :—

Causes of
failure of
vaccination.

(a) The individual was not susceptible to the virus.

(b) The operation was carelessly performed.

(c) The use of too small a quantity of lymph.

(d) Scarifications too deep, resulting in the effusion of blood.

(e) Improper protection of the arm after vaccination.

(f) The lymph used was inactive. (It should be particularly noted, that lymph is rapidly rendered inactive by being exposed, even for a short time, to a warm temperature. *It must therefore be used as soon after its receipt as possible, and requisitions should be arranged accordingly.*)

Directions for treatment after vaccination :—

Treatment
after vaccina-
tion.

Take particular care that the arm be not rubbed, and that there be nothing tight about it.

Leave the vesicles to dry into scabs and the scabs to fall off themselves.

Do not poultice.

Remember that the arm will naturally become red and inflamed by the end of the eighth and on the ninth and tenth days after vaccination. Should it become very much inflamed, paint the whole surface of the vesicles and arm with tincture of iron (steel drops), a bottle of which each vaccinator is always to carry with him.

75. The following cards are issued by the "National Vaccine Establishment;" No. 1 (in red ink) is handed to the adult or parent on the day of vaccination; No. 2 (in black ink) on the day of inspection after vaccination.

Cards of
instruction
issued to
patients.

No. 1.

Directions.

The blood on the arm should be allowed to dry, and not be washed off until the third morning after vaccination, when it may be removed by washing gently with a little warm water and a clean flannel. No soap should be used. After this, a clean piece of linen rag may be sewed round to prevent the clothes rubbing the vaccinated place. This should be changed every morning. Vaccination shields should not be used.

Mothers, in having their children vaccinated, should know that when smallpox occurs after vaccination, it is generally due to the bad way in which vaccination has been done. One or two small places do not give the protection that four or five do. Everybody should be vaccinated a second time (re-vaccinated) when they get to about twelve years old. The Nurses of the Highgate Smallpox Hospital are always re-vaccinated before commencing their work. This has been the rule for over fifty years. None of them have taken smallpox since this rule has been observed.

No. 2.

Directions.

On the tenth or eleventh day, that is, two or three days after the inspection, the inflammation round the pox is usually at its height, and then begins to decline. The arm should still be covered with a dry, clean rag, to be changed as before. No poultices

should be applied without medical advice, for these, by removing the natural scab, prevent the arm healing as quickly as it otherwise would. If, as sometimes happens, owing to the child's state of health, the arm does not heal up readily, the child should be brought back to the station.

As a rule, the child is better without any medicine during the whole course of this vaccination, except the bowels be confined, in which case half a teaspoonful of castor-oil may be given.

Vaccinators are strictly forbidden to assemble, vaccinate, or inspect persons at any place, day, or hour other than those named in the vaccination programme; headmen are responsible that this is done, and that if the vaccinator disobeys it that they record the fact on the vaccinator's return before signing it, stating when and where the vaccinator did vaccinate or inspect the people.

Each headman is bound to attend at the vaccine station on each of the vaccinator's visits; if he is unable from sickness or owing to other duties to attend personally, he is bound to send a competent substitute.—*Vide* Rule 2 in *Gazette* of June 13, 1890.

It is a criminal offence for a headman to omit to insert in his list of unvaccinated persons any adult or child living in his wasama who has not been successfully vaccinated, i.e., who has no certificate A, or the marks of smallpox, or the normal marks of successful vaccination.

On the date of the first visit, the vaccinator will proceed to the estate, and will personally deliver the original notice (Medical Form No. 171) to the superintendent, and he will then request his permission by handing him one of the printed notices (copy attached) to go to the lines, and to there vaccinate as many unvaccinated infants or children (whose names, etc., he is to at once record in his return) as may be necessary. He is also to ask permission to make a rough enumeration of the number of persons living in each room and line, which he is to ascertain from some one in or about the line, and is to duly record the number in his return.

N.B. — He is to ask the superintendent to kindly send a kangany or other person with him to there and then publish the notice and footnote—i.e., requirements of clause No. 8 of the Vaccination Ordinance—at each cooly line, and he will record whether this has been done or not, and the name of the person so sent with him.

On this first visit he is also to deliver a householder's schedule (Medical Form No. 190) and notice slip at each bungalow, conductor's, tea-maker's, or other house (other than the lines) on each estate. The heading is to be filled in, dated, and signed by the vaccinator, and it is to be directed to be filled in and furnished to him within fifteen minutes if the householder is in the house, if not then within 168 hours (i.e., on his second visit.)

Vaccinator to distribute a householder's schedule.

Certificate A or vaccinated arms to be shown.

N. B.—A record is to be kept of the schedules so delivered. If certain persons are recorded in such schedules as vaccinated, the vaccinator should ask to be shown the certificates A of such; if such certificates are not produced, he should then examine the arms of such persons—*vide Gazette*, Rule 8—and he is to record on the schedule whether he did so and the result. On the second visit the vaccinator will vaccinate any of these who attend at the appointed place, and will enter them in his return of vaccination, and will mark in the schedule that he has vaccinated them.

Procedure on second visit.

On the second visit the vaccinator is to attend *punctually* at the place and hour appointed. All the coolies present are to be paraded in three rows, viz., the men, women, and children separately; the numbers of each present are then to be recorded in the return; the vaccinator will then examine the arms of each individual, and will thus pick out, and place by themselves, all who have no marks of smallpox or of successful vaccination.

To obtain defaulters' name and address.

If necessary Supdt. to assist.

Should a vaccinator know, or have reason to think that any of those living in the lines on any estate are not present for inspection and vaccination at the place and hour and date appointed, he will, as far as possible, obtain and record in the defaulters' list the name, age, sex, and kangany's name of each such adult not present, or of any guardian or parent whose child is not present; if necessary he will ask the superintendent, in terms of clause 18 of the Vaccination Ordinance of 1886, to aid and assist him, and to give him information regarding such offenders.

He will then explain clauses 9 and 10 of the Vaccination Ordinance to the unvaccinated present in their own language.

Procedure if lymph be exhausted.

Should he not have sufficient lymph to vaccinate all, he will bracket all whom he has vaccinated, and mark the date on which these were done, and he will then warn the still unvaccinated (and also those vaccinated) to attend at the same place, at the same hour, on the same day in the following week.

On the third visit he will inspect those that were vaccinated on the second visit, and record the results; he will then vaccinate the remainder of the unvaccinated and vaccinate again all failures, and will mark as absent, and record in the defaulters' list, any vaccinifers or still unvaccinated who failed to attend at this third visit. He will also warn those vaccinated, and any still unvaccinated, to similarly attend on the fourth visit.

Procedure at third visit.

No vaccination or inspection is ever to be done at any place, hour, or date other than as fixed in the programme.

Programme to be adhered to. *Estate vaccinators are specially warned not to infringe this order.*

Those vaccinated should be kept under observation for half an hour, so as to prevent them from rubbing out or washing out the lymph.

General instructions to Vaccinators.

Estate vaccinators are directed to always on the first visit hand the notice (Medical Form No. 171) to the superintendent *personally* if on the estate, and if the usual superintendent is not on the estate, then to the person (assistant, conductor, or kangany) for the time being in immediate charge of the estate.

When they deliver the notice to any one other than the usual superintendent of the estate, they will invite his attention to paragraph 1 of the N. B. of the notice, and are always to inform such person that *he* is the person responsible for causing the notice to be published, but that he should hand the notice to the actual superintendent immediately on his return to the estate.

They are on the second visit to ascertain from some one present at the muster or at the factory or lines (and are to record on each return and defaulters' list) whether the notice was or was not duly published at all the lines and musters, and are to record the name of the person or persons who gave the information.

N. B.—If the notice was not duly published, the vaccinator is to report this at once by special letter or post card.

The signature of the superintendent or assistant superintendent (or if these be absent from the estate, of the conductor or kanakapillai or head kangany) should on each and every occasion when at all possible be obtained in the last column of the return (Medical Form No. 53), or in a special book kept for the purpose, and they should always then certify to the place, date, and hour, giving the hour of arrival and departure of the vaccinator, and should state whether or not all who presented themselves were vaccinated or inspected respectively, and that those marked absent were so.

Letters to Superintendent of Estate.

To the Superintendent———Estate.

1. Please allow the bearer, estate vaccinator, to go to the lines and to make a rough enumeration of the numbers living in each room and line, so that he may know whether all living in the lines attend for inspection and vaccination at the appointed place next week.

2. I would suggest that you should now send a conductor or kangany or a cooly to accompany him to each line on the estate, and to *there and then* publish this notice, and to warn *all living in the lines* that they are bound to attend on this day week, at the hour and place appointed in this notice.

Date : _____

Superintendent of Vaccination.

Vaccination Offences.

Vaccination offences. Cl. refers to Vaccination Ordinance No. 20 of 1886.
Rgl. refers to Vaccination Regulations published in *Gazette* of June 13, 1890.

Adults.

- Cl. 5 (a) Failed to present himself for vaccination.
(b) Failed to present himself for re-vaccination.
- Cl. 8 (c) Failed to present himself for inspection at the general muster on estate.
- Cl. 9 (d) Failed to present himself for inspection after vaccination.
(e) Refused to allow himself to be again vaccinated.
(f) Failed to present himself for inspection after second vaccination.
- Cl. 10 (g) Wilfully washed out or removed the lymph.
(h) Wilfully caused or permitted the lymph to be washed out or removed.
(i) By application or otherwise interfered with, or prevented, the due perfection.
(j) Caused applications to be made or otherwise interfered with, or prevented the due perfection.
- Cl. 15 (k) Hindered or obstructed in the discharge of his duties.
- Rgl. 8 (l) Refused to allow vaccination officer to examine arm for vaccine marks.
- Rgl. 9 (m) Failed to fill in householder's schedule.
(n) Failed to furnish householder's schedule within specified time.

Parents or Guardians.

Same offences as (a) to (l) inclusive, but in (a) to (f) say "failed to take or cause child to be taken," and in (g), (h), (i), and (j) add "of child."

Superintendents of Estates.

Cl. 7 (p) Failed to cause notice to be published.

| | | | |
|---------|-------------------------|---|-----------------------|
| Suplts. | Cl. 18 (q) Failed to | { | (1) Aid and assist. |
| | | | (2) Prevent offences. |
| | | | (3) Give information. |

Extracts from "On the Diagnosis of Smallpox in its Early Stages."

By Thomas D. Savill, M.D., London.

A typical case of variola with the pustular rash well out is, perhaps, one of the easiest diseases to recognize; but the difficulties in the diagnosis of incipient smallpox as we see it in the present day are often very great.

(a) The means on which reliance may be placed for diagnosis before the appearance of the typical popular eruption are:—

The Sudden Advent of Pyrexia in a previously Healthy Person.—A more liberal use of the thermometer would, I believe, often lead to an early detection of the malady. On the first day of onset the temperature runs up suddenly to 102° F. or more, and remains up more or less till the eruption appears on the fourth day, when it begins to fall, and the patient feels much better. In my experience this preliminary fever, accompanied by *malaise*, occurs in even the mildest cases, and its severity is no guide to the subsequent course of severity of the disease. This sudden advent of pyrexia occurs in only two other acute specific diseases common in this climate, namely, scarlatina and erysipelas, and is of itself therefore a most valuable means of detection.

Other Constitutional Symptoms.—Along with the initial fever there are other constitutional symptoms which are more common in variola than other kindred diseases, and which are, moreover, of a very characteristic kind. Chief among them are severe pain in the back, and sickness or vomiting. "Aching all over," the patient tells you, but much worse in the back and loins, with the symptoms of a "cold." The three symptoms—sudden advent of pyrexia, pain in the back, and sickness—especially when occurring in a district where variola may possibly have been imported, are quite distinctive of the disease. The lumbar pain

and sickness are rarely as marked in scarlatina or erysipelas, but all three diseases call for some sort of quarantine precaution; and in the course of thirty or forty hours the appearance of either the red blush spotted with tiny papules of scarlatina, or the raised marginated erythema of erysipelas will decide in which category the case should be placed.

Initial Rashes.—In certain more or less rare cases of smallpox an initial rash appears before the typical eruption of the fourth day. It appears usually on the second or third day of the disease.

Date of appearance of Rash.—It is generally stated to be three days after the onset—namely, the fourth day of disease.

The True Eruption. (a) The true eruption of smallpox always starts as hard round isolated papules. Like measles, it first shows itself on the face, and also at the same period of the disease (fourth day). These two eruptions are often extremely hard to distinguish off-hand (b) Both are papular, but measles has a tendency to be flat, whereas variola has a tendency to be “shotty” and round. (c) In measles the papular character begins to subside at the end of about twelve hours; but in smallpox the shotty papular character goes on increasing, and passes in forty-eight hours into the vesicular and thence into the pustular stage.

The Eruption in Mild Modified Cases.—The eruption of chickenpox may be distinguished from smallpox by the absence of premonitory fever, the rash being the first, often the only, symptom noticed in the former disease. Moreover, the papular stage is very transient, giving rise in a few hours (as compared with two clear days) to a clear vesicle on a slightly inflamed base, without induration. The face is not, as in variola, the most favourite place, and different stages of the eruption may always in chickenpox be seen at the same time.

It should always be borne in mind that smallpox as we see it in the present day presents many degrees of severity, and some cases are so trivial as scarcely to merit the patient's notice, from the scanty rash and few symptoms, much less to impede him in his work. These cases require to be diagnosed from *acne*. This can only be done (a) by the position, for *acne* favours the roots of the hair, and (b) by the fact that the *acne* spots may generally be seen in several stages, and some nearly always show the small points of comedones. In the mildest case of smallpox some constitutional signs may generally be discovered by careful investigation. A few isolated papules occurring (and not becoming vesicular or pustular) on the fourth or fifth day of an illness are most probably smallpox.

Characters on Palpation.—The feel of a smallpox rash is another point only second in importance to the element of time.

Palpation. To pass your hand over the forehead and cheeks is a procedure which should never be omitted in a doubtful case. In this way the disease could almost be diagnosed in the dark. I know objections may be urged, but the advantages are very great, for the hard shotty lumps of smallpox, which can be felt even before they are visible, are totally different from the feel of the soft flat margined papules of measles, or the non-indurated vesicles of varicella.

These are the chief diseases which in actual practice are liable to be confused with incipient smallpox.

Facts Concerning Vaccination, for Heads of Families.

Vaccination and Smallpox.

You can be vaccinated free of charge by the public vaccinator of your district.

Should smallpox break out at your house or among your neighbours, see at once to the vaccination of the household, and to the re-vaccination of all persons over twelve years of age; and at the same time inform the Medical Officer of your district.

During the prevalence of smallpox in the neighbourhood, the attention of heads of families is particularly invited to the necessity of at once taking all possible steps for protection against attacks by securing the vaccination or re-vaccination of every member of their households who is still unprotected. Vaccination and re-vaccination may be had, free of expense to the applicant, at the authorized public stations. Under ordinary circumstances re-vaccination should be done as each person reaches the age of fifteen: but there being immediate danger of smallpox, all persons over twelve years of age who have not already been re-vaccinated should have this operation performed without delay.

Smallpox in its natural state is one of the most loathsome, disfiguring, and fatal diseases in the world. Not only so, but it is very infectious, and may be caught in a multitude of ways of which most people take no account. The only protection of any avail is vaccination, which not only modifies very greatly the severity of an attack, robbing the disease of half its terrors, but, in the great majority of cases, wards off an attack altogether.

It is very important that the protection which vaccination affords against attacks of smallpox should be properly understood. Efforts are constantly being made by misguided and imperfectly informed persons to make people believe that vaccination is injurious, and that it has no effect whatever in diminishing the fatality of smallpox either amongst communities or in individuals.

As to the alleged injury from vaccination, all competent authorities are agreed that with due care in the performance of the operation, no risk of any injurious effects from it need be feared. If there be any such risk, it can only be of the most insignificant kind, and against it has to be set the enormous protection against an attack of smallpox which vaccination affords.

It may in isolated cases occasionally happen that undue inflammation or even erysipelas will follow the performance of vaccination, but the same result may follow (and often does) any trifling hurt or abrasion of the skin, such as a sore place or the scratch of a pin. Vaccination confers so great a protection against smallpox, that no wise parent will hesitate to avail himself of it because of the remote possibility of setting up through it some inflammatory action which any other puncture would have equally sufficed to cause. No one would argue that because a certain number of infants are suffocated every year by bed-clothes, therefore all babies must sleep in the cold. Yet this is quite as rational as to say that vaccination shall not be practised because it may occasionally set up inflammation or erysipelas in children's arms.

The fear that a foul disease may be implanted by vaccination is an unfounded one. Such mischief could only happen through the most gross and culpable carelessness on the part of the vaccinator; and as all medical men now receive special training in vaccination, no risk of this kind need be at all apprehended. Of course vaccination, like everything else, requires a reasonable amount of care in its performance. The alleged injury arising from vaccination is, indeed, disproved by all medical experience.

The advantages of vaccination are, on the other hand, great and undoubted. Before its discovery the mortality from smallpox in London was forty times greater than it is now.

It is the universal experience in every epidemic of smallpox, that people who are properly vaccinated escape attack to an immensely larger extent than unvaccinated people, whilst if a vaccinated person happens to catch the disease, he has a very much greater chance of recovery than the unvaccinated.

It is therefore suggested as a wise precaution that not only should every unvaccinated person be protected without a day's delay, but all vaccinated persons over twelve years of age should, at the present time, at once be taken to the public vaccinator or the private medical attendant, in order that any further risk of attack by smallpox may be effectually guarded against.

NOTES.

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In the event of an increase of the amount insured under a Policy, the premium on the additional amount may be calculated at the annual rate when an agreement or understanding is come to with the insured that the Policy shall be renewed, at the date of expiry, for a period of not less than one year for the full sum.

Adjoining Buildings.

Two or more buildings adjoining each other are to be charged the highest rate applicable to either, unless the same be divided by a party wall of Brick and/or Cabook and/or Stone, not less than 18 inches in thickness, and carried at least one foot above the roof, in which case each section may be rated as a separate Risk.

Floating Policies.

Floating Policies covering not more than three specified Risks may be issued at a rate 25 per cent. higher than the highest rate applicable to any one of them; if covering more than three specified Risks, at a rate 50 per cent. higher than the highest rate applicable to any one of them.

Policies covering in one sum the contents of more than one godown which are contiguous or adjacent and in the sole occupation of the Insured are exempt from the above additional charge.

No Floating Policy can be issued extending to Risks situated beyond the limits of the Municipalities of (1) Colombo, (2) Kandy, or (3) Galle.

Steam Carpentry.

Any Building in which sawing of timber, or other carpenter's work by steam power is carried on, is to be rated specially, but at not less than $\frac{1}{2}$ per cent.

**Minimum Rates of Premium for the Buildings and Contents
of Tea Factories, Packing Rooms, and Stores.**

| | 1 In which no with- ering or firing is car- ried on and without Engine or Stove. | 2 In which withering alone is carried on. | 3 In which firing alone is carried on. | 4 In which both withering and firing are carried on. | 5 Isolated building containing Steam and/or Oil Engine, Boiler and/or Stove. |
|--|--|---|--|--|--|
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| A.—Buildings construct- ed throughout of iron, stone or brick, with iron or tiled roofs (wooden floor- ing, rafters and supports allowed) ... | $\frac{1}{4}$ | $\frac{3}{8}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{3}{4}$ |
| B.—Buildings construct- ed of brick, stone, or iron pillars with weather boarding and/or wattle-and- daub, and iron or tile roofs ... | $\frac{1}{4}$ | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{8}$ | $\frac{3}{4}$ |
| C.—Buildings construct- ed of brick, stone, or iron pillars with weather boarding and/or wattle-and- daub, and shingle roofs, also wooden and wattle-and-daub buildings with iron or tile roofs ... | $\frac{3}{8}$ | $\frac{3}{8}$ | $\frac{3}{8}$ | $\frac{1}{2}$ | $\frac{3}{4}$ |
| D.—Wooden and/or wattle-and-daub build- ings with shingle roofs ... | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 | $1\frac{1}{2}$ | $1\frac{1}{2}$ |

NOTE.—Policies issued under this Tariff are subject to the following conditions, viz.:—

That all Tea Drying Machines be regularly cleaned out and fluff removed at least once a week, also that all Chimneys and/or Flues carrying off the products of combustion be of incombustible material, be kept in a good state of repair and free from any woodwork or other combustible material.

The Tariff rates are to be increased by—

$\frac{1}{2}\%$ when a building contains not more than one circular saw worked by power, which is used only for cutting up wood for fuel.

$\frac{1}{4}\%$ when the external pillars are not carried up to the roof. To apply to classes B. & C.

$\frac{3}{8}\%$ when charcoal fires are used in withering houses.

N.B.—No extra rate is chargeable for chulas and/or charcoal fires in a Tea Factory where the firing rate is already paid, if these are on the ground floor only of the Factory.

The Tariff rates may be reduced by—

$\frac{1}{8}\%$ when water power only is in use, and there is no steam and/or oil power available.

$\frac{1}{8}\%$ where wire weaving is employed for withering purposes.

N.B.—In no case however shall the aggregate deductions allowed as above exceed $\frac{1}{2}\%$; and no Risks be accepted at lower rates than appear in column 1.

A specific value must be placed on Withering Tats as distinct from either "Building" or "Fixtures."

Minimum Rates for Cooly Lines.

| | | | |
|--|-----|-----|-------------|
| (1) Brick or Stone Walls, with Iron or Tile Roof ... | ... | ... | 8 per cent. |
| (2) Wattle-and-Daub Walls (Brick or Stone Pillars) | | | |
| with Iron or Tile Roof ... | ... | ... | 3 " |
| (3) Wattle-and-Daub Walls (Wooden Pillars) with | | | |
| Iron or Tile Roof ... | ... | ... | 8 " |
| (4) Weather Boarding Walls, with Iron or Tile Roof | 1 | | " |
| (5) Brick or Stone Walls, with Shingle Roof ... | 1 | | " |
| (6) Wattle-and-Daub Walls (Brick or Stone Pillars) | | | |
| with Shingle Roof ... | ... | ... | 1 |
| (7) Wattle-and-Daub Walls (Wooden Pillars) with | | | |
| Shingle Roof ... | ... | ... | 1 |
| (8) Weather Boarding Walls, with Shingle Roof ... | 1 | | " |

**Minimum Rates of Premium for Buildings and/or Contents of
Desiccating Factories and/or any Building where the drying of
Coconut by Artificial Heat is carried on.**

| | Within the Municipal Council Limits of Colombo, Kandy, or Galle. | | Elsewhere in the Island. | |
|---|--|---------------------|--------------------------|---------------------|
| | With Warranty A. | Without Warranty A. | With Warranty A. | Without Warranty A. |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| A.—Buildings constructed, &c. (as in Tea and Rubber Factory Tariff) | $\frac{3}{4}$ | 1 | $\frac{1}{2}$ | $1\frac{1}{2}$ |
| B.—Buildings, &c. ... | $\frac{1}{2}$ | $1\frac{1}{2}$ | $\frac{5}{8}$ | $1\frac{5}{8}$ |
| C.—Buildings, &c. ... | $\frac{3}{8}$ | $1\frac{3}{8}$ | $\frac{1}{2}$ | $1\frac{1}{2}$ |
| D.—Wooden, &c. ... | 1 | $1\frac{1}{2}$ | 1 | 2 |

Warranty A.—It is warranted that no fibre in a wet condition or otherwise be allowed to be stored or treated in the buildings hereby insured or within a radius of 30 yards of the same.

In classes B. & C. above, where the external pillars are not carried up to the roof $\frac{1}{8}$ % extra must be charged.

**Minimum Rates in Premium for the Buildings and Contents
of Cardamom and Cocoa Factories.**

| | Per cent. |
|--|---------------|
| A.—Buildings constructed throughout of iron, stone, or brick, with iron or tiled roofs (wooden flooring, rafters, and supports allowed) ... | $\frac{3}{4}$ |
| B.—Buildings constructed of brick, stone, or iron pillars with weather boarding and/or wattle-and-daub, and iron or tile roofs ... | $\frac{1}{2}$ |
| C.—Buildings constructed of brick, stone, or iron pillars with weather boarding and/or wattle-and-daub, and shingle roofs, also wooden and wattle-and-daub buildings with iron or tile roofs ... | $\frac{5}{8}$ |
| D.—Wooden and/or wattle-and-daub buildings with shingle roofs ... | 1 |

Steam and/or oil power, chulas (charcoal and sulphur fires) and apparatus for hot air drying may be used; but no deduction is allowable if these are not used.

In classes B. & C. above, when the external pillars are not carried up to the roof, $\frac{1}{4}$ per cent. extra must be charged.

CEYLON.

**Minimum Rates of Premium for the Buildings and Contents of
RUBBER FACTORIES, SMOKE HOUSES AND STORES.**

| | 1 In which no smoking or drying by artificial heat is carried on. | 2 In which drying by artificial heat is carried on but no smoking. | 3 In which curing by smoking is carried on. | 4 Detached building containing steam and/or Oil and/or Gas Engines and/or Electric Plant. |
|---|--|---|--|--|
| | Percent. | Percent. | Percent. | Percent. |
| A.—Buildings constructed throughout of stone, brick or iron with roofs of tiles or iron (wooden flooring, rafters and supports allowed) ... | 1 | 1 | 2 | 1 |
| N.B. If roofed with shingles $\frac{1}{2}\%$ extra. | | | | |
| B.—Buildings constructed with weather boarding and/or wattle-and-daub, with pillars of stone, brick or iron carried up to the roof, and with roofs of tiles or iron ... | 1 | 2 | 1 | 1 |
| N.B. If roofed with shingles $\frac{1}{2}\%$ extra. | | | | |
| C.—Buildings constructed with weather boarding and/or wattle-and-daub, with pillars wholly or partly of wood and with roofs of tiles or iron ... | 2 | 1 | 1 $\frac{1}{2}$ | 2 |
| D.—Buildings constructed throughout of wood and/or wattle-and-daub, with shingle roofs ... | 1 | 2 | 2 | 1 |

In classes B. & C. above, when the external pillars are not carried up to the roof, $\frac{1}{2}$ per cent. extra must be charged.

General Tariff (Bungalow).

| | Percent. |
|---|----------|
| Bungalows outside the Municipal Limits of Colombo and/or Kandy and/or Galle:— | |
| 1. Brick and/or cabook and/or stone walls with tiled and/or iron roof | 1 |
| 2. Brick and/or cabook and/or stone walls with shingle roof | 3 |
| 3. Wattle-and-daub walls with tiled and/or iron roof | 1 |
| 4. Wattle-and-daub walls with shingle roof | 3 |
| 5. Walls of weather boards with tiled and/or iron roofs | 1 |
| 6. Walls of weather boards and/or weather boards and wattle-and-daub with shingle roof | 3 |
| 7. Walls of mud and weather boarding with shingle roof | 1 |
| 8. Any bungalow with thatch on roof either by itself or over iron | 1 |

RULES RE MOTOR CARS AND CYCLES.**1. Steam-driven Cars (the boiler being fired by coal, coke or other solid fuel).**

If taken into buildings, the following requirements must be observed:—

If the boiler is "underfed" it must be provided with a metal foot-plate fitted close to the front of furnace, and turned up not less than three inches on all sides.

The ash-box to be so constructed that it can be entirely enclosed, and the air-draught to be controlled by a separate damper above the level of the fire bars.

An efficient spark-arrester and baffle-plates at base of funnel to be provided.

"Clinkering" to be done in the open only, well away from all litter, with water available close at hand.

When housed at night and at other times when at rest, they must be placed in a building used for no other purpose and having floor, walls and roof constructed of, or lined with, incombustible material.

When under steam in other buildings the following Rules must be observed:—

- (a) Ash-box to be kept entirely closed; no ashes or cinders to be removed.
- (b) Steam blast not to be used.
- (c) Not to be left unattended at any time and not to be allowed to remain in the building for any longer time than is necessary for loading and/or unloading.

Cars should not be permitted to enter buildings in which Vegetable Fibres are deposited except in a loading place which has the whole of the walls and roof of incombustible material or lined therewith, and in which loading place no goods are allowed to be stored.

Vegetable Fibres and other similarly inflammable goods, when being conveyed on steam-driven Motor Cars, should be sheeted over.

II. Steam-driven Cars using liquid fuel.

III. Cars fed by petrol, in which the motive force is internal explosion.

(a) To be housed in a building not used for any other purpose either detached or cut off by a complete wall from other buildings. The building must be well ventilated and no petrol or other liquid fuel (except that in the Car reservoir and such as may be necessary for immediately re-charging the same) must be allowed therein.

(b) Petrol and other liquid fuel to be stored in a lock-up outlying building having an earthen floor, used for no other purpose. No artificial light or heat to be used therein. The Petrol to be kept in air-tight metal vessels only, not exceeding a capacity of five gallons each. The total quantity not to exceed 60 gallons.

(c) No smoking permitted in the Motor Car house or Petrol Store.

(d) Motor Cars using petrol or other liquid fuel should not be permitted to enter any Warehouse or other building in which goods are placed, except a loading place as above described in Section I.

(e) They must not be re-charged with petrol, nor left unattended at any time, except in a separate building as described in paragraph (a) above or in the open.

IV. Motor Cycles fed by petrol.

The Rules under headings II. and III. apply only to Motor Cycles where two or more are deposited. Temporary storage during the day-time may be allowed under the following conditions:—

(a) To be stored only in an open-fronted verandah having incombustible flooring.

(b) No petrol to be stored within the building other than that contained in the tanks attached to the cycles.

(c) No re-charging with petrol while in the building.

Storage of Carbide of Calcium.

Calcium Carbide must be kept in strong hermetically sealed metal vessels. It must be stored only in a position not exposed to moisture. The Building or Compartment in which it is placed should be well ventilated to open air. Large quantities should only be stored in isolated, well ventilated, places set apart for the purpose, in which no artificial light or heat is used.

Storage of Volatile Products of Petroleum.

(Known under various names, e.g., 'Gasolene, Naptha, Petrol, Benzine, Benzoline and Petroleum Spirit).

Storage must be only in air-tight metal vessels.

The spirit must be handled only in day light, and it must be kept in separate compartments well ventilated to outside air.

REGULATIONS.

In retail stores not more than 4 gallons allowed, with Warranty that it be kept in closed metal vessels with metal stoppers, each of a capacity not exceeding 2 gallons; that it be drawn off by day light only; that no artificial light or heat be permitted in the room where it is stored, and that the room have good ventilation to outer air.

Larger quantities than 4 gallons to be in all cases stored in unbroken packages only in a separate well ventilated building set apart for the purpose, with Warranty that no artificial light or heat be allowed therein.

Risk of Fire Caused by Earthquake and Riot and Civil Commotion.

It is not permissible to cover loss or damage by fire occasioned by or through or in consequence of (a) earthquake or (b) riot and civil commotion unless it be by a separate Policy, or by incorporation in or endorsement upon an existing Policy of the following clause, and unless in either case the prescribed premium or additional premium for these respective Risks shall have been charged.

Loss or damage other than fire, explosion or lightning, may not be covered by a Fire Policy.

Rates Referred to Above.

| | | |
|--------------------------|--------|--|
| | | Not less than per cent. per annum. |
| Riot and Civil Commotion | -- | 5s. -- $\frac{1}{2}$ per cent. for any period not exceeding 12 months. |
| Earthquake | ... .. | 1s. 3d. -- $\frac{1}{16}$ per cent. |

Hazardous Goods.

The following Goods are to be deemed Hazardous :—

| | |
|-----------------------|--------------------|
| Benzine | Candles |
| Benzoline | Cartridges |
| Bi-Sulphide of Carbon | Charcoal (Powder) |
| Brimatone | Chlorate of Potash |
| Camphine | Chlorate of Soda |
| Camphor | Cocunut Oil |

| | |
|--|---|
| Cordite | Petroleum and its products |
| Cotton (whether in fully pressed bales or otherwise) | Phosphorus |
| Explosives of all kinds | Pitch |
| Fireworks | Potash |
| Fulminating Powder | Rags |
| Grasses of all kinds | Resin |
| Gunpowder | Rockets |
| Hay | Rock Oil |
| Jute (in fully pressed bales or otherwise) | Saltpetre |
| Kerosene | Schwefelfarben (Sulphur dyes) |
| Lampblack | Stearine |
| Lime | Straw |
| Matches of all kinds | Shoddy |
| Mungo | Spirits of all kinds, not in bottles |
| Naphtha | Tallow, Manufactured or Un-manufactured |
| Nitrate of Potash | Tar |
| Nitrate of Soda | Turpentine |
| Nitro-Glycerine | Varnish |
| Oils of all kinds | Vegetable Fibres of all kinds |
| Paraffin | Waste of all kinds |

A small quantity of Oil or of any chemical product or liquid in bottles, of loaded Cartridges not exceeding one thousand, of Safety Wax Matches not exceeding ten gross of boxes, or of Kerosene Oil not exceeding six cases may be kept on the premises for private use or for retail purposes only, without incurring the additional charge for Hazardous Goods.

Wines, Spirits, Manufactured Tallow, Coconut Oil and Essential Oils, Coir Yarn, Coir Fibre (not exceeding 5 tons), Palmyra and Kitool Fibre, when packed ready for shipment either in cases, casks, dholls, ballots, drums, or otherwise, are not deemed Hazardous Goods.

Rating and Definition of Fire Proof Buildings.

A reduction of 20 per cent. is allowed on the Normal Rates for certain classes of risk for buildings (and their contents), which are entirely constructed of incombustible material, in conformity with the following definition:—

“ A Fire-proof building is one which constructed of burnt brick or stone or of ferro-concrete or reinforced concrete, with roof of masonry or concrete or tiles and glass or asbestos slate on steel

or iron frame, and in which no timber or other combustible material is used except in doors and window frames in external walls."

Note.—External walls or reinforced concrete must not be less than 6 inches and party walls not less than 13 inches in thickness, and roofs of reinforced concrete must not be less than 3 inches thick in any part.

Concrete must be reinforced in every part with embedded metal rods or bars spaced not more than 12 inches apart, securely connected or over-lapping at least 6 inches at all abutments and intersections, having also bands or bars across the thickness of the concrete.

Concrete may be composed of sand and gravel that will pass through a $\frac{3}{4}$ inch mesh or of broken brick, burnt ballast, furnace slag, clinker or other similar hard and burnt material, but in any case the cement used must be Portland (equal to the British Standard Specification of December, 1914) in the proportion of 6 cwt. of cement to each cubic yard of concrete. The concrete must be thoroughly mixed both dry and wet, and must be rammed round the metal work in position, every part of which must be completely enclosed with solid concrete.

Composition Roofs

Comprise roofs covered with layers of sheet asphalt (i.e., paper or felt treated with asphalt or bituminous material) cemented together, not less than 1/16th of an inch thick, and protected externally either by—

- (a) A sheeting of incombustible material at least 1/32nd of an inch thick cemented thereto, or
- (b) A coating of small stones or gravel at least half an inch thick embedded in asphalt or bituminous material.

The roofing material must be built into the walls at the edges or turned over the eaves, and any edges left exposed must be protected by metal covering.

Roofings complying with this description are to be considered as an intermediate class between first and second class roofings, for which a moderate extra rate not exceeding 1/16 of 1 per cent. is to be charged.

The above is not to be applied to buildings of first class construction. In the case of such buildings, composition roofs, laid on the top of roofs which comply with the definitions prescribed in that class, may be allowed free of charge.

In columns 1 and 4 the following Warranty is required :—

Warranted that during the currency of the Policy all chimneys and/or flues carrying off the products of combustion be of incombustible material, be kept in a good state of repair and free from any woodwork or other combustible material.

In column 2 the following Warranties are required :—

Warranted that during the currency of the Policy the furnaces used for generating heat are situated outside the factory and separated from it by a solid wall of stone or brick, not less than 18 inch. thick, through which only heated air is introduced.

Without such Warranty an additional $\frac{1}{8}$ % must be charged.

Warranted that during the currency of the Policy all chimneys and/or flues carrying off the products of combustion be of incombustible material, be kept in a good state of repair and free from any woodwork or other combustible material.



NOTES ON CERTAIN DISEASES OF ANIMALS.

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ANTHRAX.

This is a contagious disease, principally affecting cattle, but it may be communicated to all animals. Human beings may be inoculated, especially those engaged in making post-mortems or skinning dead cattle. It is caused by a microbe, the *Bacillus Anthracis*, which is found in the blood immediately after death in the form of short rods.

SYMPTOMS AND PREVENTION.

The attack and death are usually very sudden. An animal left well a few hours previously is found dead or dying; often blood oozes from the nostrils and anus. After death the carcase rapidly swells, and blood oozes from the nostrils and anus. In such cases suspicion should be aroused and precautions taken. The carcase should not be opened or blood allowed to contaminate the ground. It should be burned, if possible; if not, buried deeply, with quicklime or disinfectants.

Contaminated soil should be scraped off and buried with the carcase. The shed floor should be covered with strong disinfectant solution. Usually cases occur singly, and the disease does not spread if such precautions are taken.

DIAGNOSIS.

For diagnosis one ear may be pricked after death, *before decomposition sets in*, and one small drop of blood smeared very thinly on a glass microscopic slide, or failing this a piece of thin window glass. The smear must be transparent: it will dry in a minute or two. It should be wrapped in a piece of clean white paper, packed in a small tin, and forwarded to the Government Veterinary Surgeon.

FOOT-AND-MOUTH DISEASE IN CATTLE.

Foot-and-Mouth Disease is a disease both contagious and infectious, and nearly all animals may suffer from it. As is indicated by its name, the feet and the mouth are the principal parts affected. In some outbreaks the feet are chiefly affected, in others the mouth, in most cases both mouth and feet.

The animal is feverish, there is constipation—if a milking cow the quantity of milk is diminished—loss of appetite, and probably a rough, staring coat. Generally a peculiar smacking of the lips is heard, there is a flow of saliva from the mouth, and generally lameness in one or more feet. The special eruptions are in the form of blisters containing a clear fluid, and are found on the upper surface of the tongue, on the roof of the mouth, and gums. The feet are swollen and hot, and the blisters appear at the back part of the foot and between the toes.

It is a mild disease, and many animals should not die from it if they are properly looked after. The feet especially should be kept clean, otherwise the matter penetrates or burrows down into the flesh and involves the tendons and ligaments, and even the bones, eventually causing the hoof to drop off.

TREATMENT.

All the affected animals must be segregated, as far as possible.

For mouth and feet dressing the following are simple, good, and cheap:—

MOUTH DRESSING.

Powdered alum (bazaar name "Sinakkaran") ... 1½ ounce.

Water 1 pint.

A little to be poured into the mouth night and morning.

FEET DRESSING.

Powdered sulphate of copper (bazaar name "Palmanikkan") 1½ oz.

Alum 1 oz.

Water 1 pint.

Apply to the sores on the feet twice a day.

Stockholm tar should be applied to the feet daily, over the sores.

The feet must be kept quite clean by washing with water containing a little Jeyes' fluid daily.

When the sores on the feet do not heal properly the following dressing should be applied, in addition to the above, twice a day with a feather:—

Margosa oil or Coconut oil 8 parts.

Turpentine 2 parts.

Internally give $\frac{1}{2}$ or $\frac{2}{3}$ lb. of Epsom salts daily for three or four days in a quart of congee, which will relieve the constipation and fever, or a dose of oil as a laxative.

PREVENTION.

With the view of preventing infection the healthy cattle and the sheds may be sprayed with Jeyes' fluid and water daily, and both healthy and diseased cattle may get 10 drops of Jeyes' fluid daily in the food (or in a quart of congee) for a week. It should then be stopped for three days and repeated if necessary. Infected cattle must be kept in strict segregation and not allowed to go to the same fields or drinking places as the healthy cattle.

RINDERPEST.

Cattle Plague or Murrain.

Sinhalese—*Wasungataroga*. Tamil.—*Mattu-Kotari* or *Mattu-Pedi*.

Rinderpest is a very contagious disease, especially affecting cattle and buffaloes, the cause of which is not yet discovered. Sheep, goats, deer, camels, and some swine may be attacked—not man, horses, dogs, birds.

SYMPTOMS.

Fever, indicated by a rise in temperature from 101.5° F. to 105° F. or over. The animal refuses to eat, and is dull; ears drooped; hair erect over the back, and sometimes shivering is noticed. Breathing is quickened, and a watery or mucous discharge flows from the eyes, mouth, and nose. In cows the secretion of milk is diminished or arrested. An eruption resembling scales of bran may be noticed inside the mouth. The bowels are at first constipated, but soon acute diarrhoea sets in, when the dung has a foul smell and is mixed with shreds of mucous and blood. The animal loses strength and flesh rapidly, and may die in the course of a week.

The disease spreads rapidly from one animal to another. If an animal is opened after death, acute congestion and ulceration of the fourth stomach and intestines is noticed.

Dogs and birds, by carrying away parts of the carcass, help to spread the disease.

The discharges from a sick animal are highly infective.

PREVENTION AND SUPPRESSION.

A diseased animal must be isolated, and all cattle in contact with it in separate sheds for at least ten days from the last case. It is a good plan to spray cattle, by means of a garden syringe, over the body with a disinfectant solution and to sponge down the face and nostrils with the solution daily. Sheds should also be sprayed, especially the mangers and floor; walls limewashed, and the wash should contain some disinfectant.

A teaspoonful of Jeyes' fluid or cyllin to each pint of water is a useful proportion for this purpose. Sulphur and gas-tar may be burned near the sheds. Five drops of Jeyes' fluid or cyllin may be given daily in the food to each animal for four days, stopped for two days, and repeated. Attendants upon the sick must not go to the healthy cattle without washing the hands and feet and changing the clothes. Waste litter, dung, and waste food from the sick cattle should be burned. Dead animals should be buried six feet deep with disinfectant solution or quicklime put over the body.

Care must be taken not to infect the water supply or food.

The law requires all cases to be reported to the nearest headman or police officer.

Recovery from the disease prevents another attack.

TREATMENT.

No particular line of treatment can be relied upon, but the following has been found distinctly useful in this country:—

(1) As soon as the animal is noticed to be ill (it is important to give this in the earliest stage):—

| | |
|---|----------|
| Turpentine, 2 tablespoonsful (2 ounces) | } mixed. |
| Raw linseed oil or gingelly oil, 1 pint ($\frac{1}{2}$ bottle) | |

This may be given with advantage to all contacts, as it seems to modify the bowel lesions a good deal if an attack follows, and it can be repeated four days later.

(2) In the case of animals *not purging*, give 8 hours after the above $\frac{1}{2}$ to 1 lb. of Epsom salts dissolved in four bottles of rice congee.

(3) Give daily night and morning for four days—

| | |
|------------------------------|----------|
| Quinine, 1 level teaspoonful | } mixed. |
| Arrack, $\frac{1}{2}$ bottle | |
| Rice congee, 4 bottles. | |

After four days give this *once a day* for a week.

If obtainable, $\frac{1}{2}$ dram of salol may be added to above.

Food should be soft—plenty of gruel or congee, tender grass; no hard food should be given until the animal is noticed to be chewing the “end.”

Recovered animals should be kept separate from non-infected animals for at least a fortnight after recovery, and the dung burned.

PREVENTIVE INOCULATION.

There are several methods of inoculating cattle to prevent an attack. The following is the simplest :—

Serum Alone Method.—In this a dose of anti-rinderpest serum—prepared from the blood of cattle highly protected—is injected under the skin by means of a hypodermic syringe and needle (syringe must be perfectly clean and should be boiled before use). It is an easy and safe method, and may be carried out by an owner himself. The protection only lasts about three weeks, and must be repeated. Animals can remain at work.

SURRA (Trypanosomiasis).

This is a disease due to the presence in the blood of small eel-like parasites (*Trypanosoma Evansi*). Both cattle and horses are affected, and sometimes dogs. The parasites develop in periods, each invasion resulting in fever and more weakness and emaciation.

The disease is spread by means of *biting flies*, which are commonly found around stables and cattle sheds, and breed in decaying manure.

SYMPTOMS.

Horses.—Fever, weakness, dropsical swellings about the sheath and abdomen, weakness of the loins, and staggering gait. These may pass off and return again in two or three weeks. Each attack leaves the animal weaker and more emaciated, until after two or three attacks the animal dies.

Cattle.—The disease is more chronic than in horses. Fever, roughness of the coat, emaciation, whiteness of the membranes of the eye (anæmia), the animal presenting a miserable wasted appearance. Paralysis of hind quarters may occur. Death may result from exhaustion, or in convulsions.

DIAGNOSIS.

At the time of high fever, in the case of cattle one ear may be pricked and a thin transparent smear of blood made on a glass microscopic slide. In the case of the horse, a small cut with a pair of scissors may be made

in the skin of the chest, and a smear of blood made. The slides should be allowed to dry, be wrapped in clean white paper, separately, and forwarded to the Government Veterinary Surgeon.

TREATMENT AND PREVENTION.

At present treatment is of little avail, and only carried out under expert supervision. It consists in the prolonged administration of arsenic.

Efforts should be made to reduce the biting flies by thoroughly cleaning away all manure from the sheds, and spreading lime. Animals should be protected from the flies by every means possible. Fly papers may be used in the sheds, and any harmless substance distasteful to flies lightly smeared on the animal's skin, such as—

| | | | |
|--------------|--------------|----------------|------------|
| Margosa Oil | ... 20 parts | Camphor | ... 1 part |
| Kerosine Oil | ... 1 part | Citronella Oil | ... 1 part |

especially about the legs, which the flies appear to attack most.

RED WATER (Piroplasmosis).

This disease, also called "Tick fever," is due to the presence of parasites (piroplasms) in the blood.

SYMPTOMS.

High fever, constipation, anæmia, emaciation. The urine is commonly red, or brownish-red, or yellow in colour. The disease is transmitted by ticks, and efforts should be made to keep animals free from ticks, especially imported cattle. As in the case of Surra, blood smears should be sent for diagnosis when the fever is high.

RABIES IN THE DOG.

Various ailments of the dog are commonly mistaken for rabies and much needless alarm given to persons bitten by a supposed mad dog.

It may, therefore, be of benefit to give a few hints as to the symptoms of true rabies and the line of action to be taken in dealing with a suspected case.

The disease is most common amongst vagabond dogs (pariahs). It may attack all domestic animals and such wild animals as the jackal, fox, hyena, wolf, and deer.

FORMS OF THE DISEASE.

In the dog it appears in two forms: (1) the raving or raging form; (2) the dumb or paralytic form.

INCUBATIVE PERIOD.

The incubative period, or the time that elapses between the bite and the appearance of the symptoms, may vary from three to six weeks or to several months, usually about the fourth or fifth week.

DURATION.

Deaths take place in about five to eight days after an attack.

SYMPTOMS.

It is difficult to describe symptoms which may not be mistaken by ordinary people. The general symptoms are—alteration of habit or temper—an anxious expression of the eyes which becomes wilder and more glaring—restlessness—a dislike of bright light or objects may be shown, the dog seeking dark corners. If it has been bitten there may be biting of the old wound or scar—there is usually refusal of the ordinary food (but not always), and morbid appetite with a tendency to eat or tear to pieces straw, wood, mats, or cushions - or to persistently lick the spot where another dog has urinated.

There is thirst and fever and the animal will drink water, but in an advanced stage it cannot swallow owing to paralysis of the larynx.

There may be biting or snapping at imaginary objects—great sexual excitement may be shown. A hacking husky cough may be present leading to the belief that the animal is choked. The voice is altered, becoming harsh and hollow with a peculiar howl. As the disease advances the fits of excitement and rage become more pronounced with a tendency to bite at anything in the way and to escape and wander—running with a peculiar long trot more or less straight ahead. Convulsions or spasms are present which become more frequent until the animal becomes more or less paralyzed and dies from exhaustion. The eyes appear glaring and red with a squinting tendency and there is usually a discharge which collects at the inner corners. There may be at first constipation, and, in the latter stages, a chocolate-coloured diarrhoea. The animal may vomit and the matter be tinged a chocolate colour. Saliva may collect in a thick and gummy form round the lips and the animal try to remove it with its paws as if choked (when this symptom is

shown great care should be taken in any attempt to examine the mouth). The master's voice produces attention, but with a half bewildered and curious expression in the eyes.

In the dumb form, in addition to the above symptoms, great help in diagnosis is given by the state of the lower jaw, which becomes paralyzed and the mouth remains partly open and saliva and dirt collect round the lips. As the jaw is paralyzed the dog cannot seize any object and hold it. There may be a purulent discharge from the nose.

POST-MORTEM EXAMINATION.

It is very unsafe to give an opinion on a post-mortem examination along without previous observation, as the appearances may be more or less negative. There is usually congestion of the mucous membrane of the larynx and there may be infiltration and swelling of the laryngeal folds or lymph may be noticed on the surface. The stomach is generally empty of food, but may contain bits of straw, string, hair, wood, feathers, or fibre with congestion and even ulceration of its mucous membrane and a chocolate-coloured fluid may be noticed. The bowels show catarrhal inflammation. There may be peritonitis and sometimes intussusception. The lungs and the tracheal and bronchial mucous membrane also show congestion.

The brain is congested and there may be effusion into the ventricles. The spleen may be slightly congested and swollen. Albumen and sugar may be found in the urine.

PRECAUTIONS.

A dog suspected to be suffering from rabies **should not be killed** if it can possibly be secured with a strong collar and chain, or put into a room or cage, as a few days' observation will decide whether it is rabid or not by the development of the symptoms described. If it is killed a definite opinion cannot be arrived at by post-mortem examination.

The carcass **perfectly fresh**, or the head only may be sent to a Bacteriological Institute for examination. If not possible pieces of the brain may be sent for examination.

Any one bitten or scratched should clean the wound immediately—soap and water and any antiseptic lotion handy—carbolic acid and water 5%—corrosive sublimate lotion 1 in 1,000—Condy's Fluid—Jeyes' Fluid—of strong boracic acid lotion. The wound must be thoroughly cleaned from the bottom, a drop of pure carbolic acid may then be applied to the wound by means of a match or small feather.

A doctor should be consulted as quickly as possible who will open up the wound, and cauterize it if necessary.

Too much value is placed upon the result of bacteriological examination of the brain and where there is strong suspicion of rabies and a wound caused by the teeth of the suspected dog, persons bitten should not wait for the result of examination but proceed to a Pasteur Institute for treatment without delay. The earlier the treatment is commenced the better.

In countries where rabies is prevalent—great care should be taken when dogs are ill—especially in making any attempt to examine the mouth or give castor-oil or other medicines. No sick dog should be petted by children.

RABIES.

NOTES.—In forwarding pieces of the brain for examination, the following preservative solutions should be used. The pieces of the brain must be obtained perfectly clean, using sterilized scalpel and forceps to remove them. Small wide-mouthed bottles are most convenient; these must also be perfectly clean. Separate specimens should be sent.

1. *For animal inoculation test*:—Two or three pieces in—

| | | |
|---------------------------|--------|----------|
| Fresh Distilled water ... | 1 part | } mixed. |
| Pure Glycerine ... | 1 part | |

2. *For microscopic examination test*:—Two or three pieces in the following solution:—

| | <i>Metric.</i> | <i>Imperial.</i> |
|--------------------------|----------------|------------------------------|
| Bichromate of Potash ... | 3 grammes | = 46½ grains |
| Glacial Acetic Acid ... | 5 cc. | = 1 fl. dram, 45 min. |
| Distilled water ... | 95 cc. | = 3 fl. ozs., 2drs., 46 min. |

Mixed 100 cc.

Extract from Annual Report.—*Pasteur Institute, Coonoor, 1916, page 27.*

1. When any person is bitten by an unknown dog without provocation he should go to Coonoor for treatment without delay. For experience has shown that it is likely that such a dog is rabid.

2. When any person is bitten by a dog which is known, and can be captured, that dog should not be killed, but securely tied up.

- (a) If it is alive and well ten days after inflicting the bite, the person need not go for treatment.

- (b) If, however, the dog falls ill or dies within ten days, the person bitten should go for treatment, and take with him portions of the dog's brain for verification, preserved according to the instructions issued.

3. Persons who are licked on the unbroken skin need not come for treatment.

4. Persons who have merely handled rabid animals and have no recent wounds need not come for treatment.

MISTAKES.

Such diseases as epilepsy, distemper, inflammation of stomach and bowels, choking, and fits of anger at being tied up, especially if under sexual excitement—irritation of dressings applied to sores, and maternal jealousy may be mistaken for rabies.

With regard to epilepsy most mistakes are made. In an epileptic fit commonly seen in distemper the animal turns round and round, champs its jaws, foams at the mouth, and falls over unconscious for a time, coming out of the fit in a dazed condition. Such cases are harmless and are not rabid.

In inflammation of the stomach or intestines the animal vomits all food and may cry out and roll with pain suddenly or desire to lay stretched out with its stomach on the ground, differing altogether from the symptoms of rabies.

In Choking.—The attack is sudden, usually at a meal or while playing with some object and is noticed by some one immediately, differing from the gradual onset of the symptoms of rabies with the changed behaviour of the dog and probable illness for a day or two previously.

Frequently dogs labouring under great sexual excitement are thought to be mad; also some females with puppies become very savage. A little reflection and observation will decide.

PREVENTION.

- (1) Reduction of numbers of vagabond dogs.
- (2) Destruction of rabid dogs after careful observation.
- (3) Bitten animals should be put under observation and all destroyed if the dog that inflicted the bite was found to be rabid.
- (4) All stray dogs should be seized, and, if not claimed in three days, destroyed. Licensing and wearing of collars should be enforced.
- (5) At every Police Station in the Island a strong barred cage should be provided for the purpose of confining and observing suspected dogs.

G. W. STURGESS, M.R.C.V.S.,
Government Veterinary Surgeon.

DOGS AND THEIR MANAGEMENT.

GENERAL TREATMENT.

The importance of judicious feeding cannot be over-rated. Over-feeding deranges the stomach, and under-feeding and poor food causes rickets in puppies and is a frequent cause of disease in dogs.

With regard to feeding, this requires to be studied in relation to the particular breed, but, as a general rule, two meals a day should be given, one in the morning about 9 or 10 o'clock, and one in the late afternoon or evening.

Clean water should always be within reach of the dog.

It is a mistake to think, as many persons do, that meat diet causes Mange, Eczema, and other skin diseases. The contrary is the case. The dog is by nature a carnivorous animal and good wholesome meat should form his staple diet. Other foods, such as rice, biscuits, Melox, etc., should only be regarded as additions to the meat diet.

GROOMING.

This is a detail of kennel management that is often over-looked. All dogs should be thoroughly rubbed down twice a day with a rough towel, and then brushed. If this is done regularly, washing is not often needed. Many dogs are washed too often and with improper soaps; on no account should Carbolic soap be used as the acid is absorbed through the skin into the system.

If a dog is troubled with fleas, blow in with miniature bellows a little "Insectibane" to the roots of the hair directly after he has been brushed. Insectibane is just as good as Keating's Insect Powder, and is far cheaper.

Where proper attention is paid to food, cleanliness and exercise, there should be very little sickness in the kennels.

A FEW COMMON DISEASES OF DOGS AND THEIR TREATMENT.

In the treatment of a sick dog avoid all roughness. Almost all dogs are excellent patients so long as they are handled properly. In giving any liquid medicine, do not open a dog's mouth, but place him between your knees with his back towards you, raise his head and pull his lips away from his teeth or one side of his mouth to form a funnel, and slowly pour the medicine into it. Keep his head up for a short time, and, if he does not swallow, slightly open his jaws. If the dose is a pill, or anything solid, place the left hand under the lower jaw and

press firmly on each side at the junction of the upper and lower jaws. This will cause him to open his mouth, and the dose should be placed as far back as possible on the tongue—not under it—, close the jaws and in most cases the dog will swallow it at once.

ABSCESS.

An abscess may be the result of a blow or accident, or be caused by inflammation. When an abscess is forming, there is usually inflammation of the part, and a hard lump can be felt. As the matter forms, it becomes softer and fluctuates under pressure. If it takes long in forming, it is advisable to poultice it. The abscess is ripe for opening when it becomes soft and moves readily under pressure. To open it plunge the lancet well into the centre and make a sufficiently large cut to ensure free drainage. Press out all matter and syringe it out with a very mild solution of Condy's fluid and warm water. In all cases of deep seated abscess a Veterinary surgeon should be called in.

MANGE.

This disease is very often mistaken for Eczema and *vice versa*. Mange is caused by a parasite, and is highly contagious whereas Eczema is constitutional and not contagious.

The common form of Mange (Sarcoptic) is so well-known that I need not describe it.

The following is a very effective remedy:—

1 teaspoonful of Turpentine.

1 teaspoonful of Stockholm tar.

1 tea-cupful of flowers of Sulphur, and sufficient Coconut oil to make it into a fairly thick paste.

This is to be well rubbed in to the root of the hair *all over the dog* even between the toes and inside the ears, and to be left on for 48 hours. Then thoroughly wash the dog and, after 48 hours, give another application. Leave it on for 48 hours, and then wash again. In the majority of cases the dog will be cured, but if after 10 days or a fortnight there are any signs of Mange breaking out again, repeat the treatment.

FOLLICULAR MANGE

is due to another parasite and is far more difficult to cure. These parasites burrow deep under the skin and are very hard to reach.

One of the first symptoms of the disease is the hair falling off in patches on which may be noticed a few pimples. The patches rapidly extend and come out on other parts of the body, and scabs form. Any hair that remains on affected parts can easily be pulled out.

Treatment.—Shave the hair off round the patches. Dress the affected parts twice a week with the following:—

Creosote 2 drachms, Linseed oil 7 ounces, Solution of Potash 1 ounce. First mix the Creosote and oil and then add the solution of Potash. Shake well before applying. In bad cases it will take any time up to 6 or 8 months to effect a cure.

ECZEMA

may be local or general, and consists of an eruption of minute vesicles. The skin has a scarlet appearance and often becomes wrinkled, and in most cases the hair falls off. Improper and over-feeding are common causes, but, I believe, the commonest to be worms.

Treatment.—Give a dose of Epsom salts, and treat for worms. Give a light diet, and give Cod Liver Oil and Parrish's Chemical food after meals. For external use dust affected parts with Boric acid or use Boracic ointment.

BREEDING AND WHELPING.

It is most important that both the mated animals should be free from worms and in perfect health. When a bitch is in whelp she should be given ample but not violent exercise. After the fifth week great care should be taken to avoid strains, but walking exercise should be given up to the last. About the sixtieth day a mild purgative should be given; usually Salad oil is enough, but if there is constipation a small dose of Castor-oil may be given.

Feeding should be regulated by the condition of the bitch, and she must not be allowed to get too fat or too lean (that is, the ribs should be apparent to the hand, but not perceptible to the eye). Soup, bread and milk and oatmeal are the best food for five or six days previous to confinement.

The best arrangement for the bitch to whelp in is a large board with a piece of carpet nailed on it and a raised edge to prevent the puppies falling off, with some straw on it. The use of the carpet is to give a foothold to the puppies when sucking.

Few bitches in the East can bring up more than three or four pups, so arrangements should, if possible, be made for a foster mother.

During whelping all undue interference should be avoided, but assistance should be at hand in case of need. No strangers should be allowed to go near the bitch. After the puppies are born the bitch should be given a drink of milk or some Brands essence, and then left alone. Milk should be given every two or three hours. After a couple of days give soup and gradually resume the ordinary food giving rather a larger allowance of meat than that to which the bitch has been accustomed.

From the first day the bitch should be encouraged to leave the puppies two or three times a day, and later on she should be exercised regularly for an hour or so a day.

Treatment of Puppies.—Puppies should be left with the dam until about six weeks old, but they should be taught to take additional food when about two to three weeks old. As the milk of the bitch is much richer than that of the cow, extra cream and a little Plasmon should be added to cow's milk. The puppies should be gradually taught to lap by dipping one's finger, or a clean piece of rag, in the food and allowing them to lick it. Gradually lower it until their tongues come in contact with the food and they will very soon learn to lap. Weaning should be done gradually and when the time comes for taking the pups away from the bitch one or two should be taken at a time until her secretion of milk has diminished.

After removal from the dam puppies should be fed six or seven times a day, and should always be fed first thing in the morning and last thing at night. At about five weeks old give raw eggs and meat juice in small quantities, and after a few days small quantities of well cooked very finely minced meat. Keep the pups dry and comfortable and let them have plenty of space to run about and play in. Gradually reduce the number of meals until the pups are about six months old, when only two meals a day should be given.

PNEUMONIA.

Symptoms.—Strong shivering but no spasms. Quick and laboured breathing. The inspirations being full and the expirations short and the breath hotter than usual.

The dog sits on its haunches with fore-legs wide apart and head thrust forward, and seldom moves unless obliged to.

Treatment.—Give a dose of Castor-oil, and see that the bowels are kept open. Keep patient in a place where there is plenty of fresh air and keep warm and dry.

Give pill three times a day of one grain Calomel, one grain Opium and $\frac{1}{4}$ grain Digitalis. The dog should be disturbed as little as possible. Diet should be rather low—broth, gruel, egg and milk, etc. Solids should not be given.

Pneumonia always leaves dogs very weak and relapses are very common. So great care is required during convalescence. Exercise should not be allowed. Give nourishing diet, broth, Virol, custard, etc., and as a tonic Parishes' Chemical food and Cod Liver oil. The return to solid food should be gradual.

PLEURISY.

Symptoms.—Shivering and spasms of chest. Inspirations short and uneven, and expirations full, breath not hotter than usual, dry cough.

Treatment, the same as for Pneumonia.—In both these diseases more depends on food, nursing, and fresh air than on medicines.

WOUNDS.

Before dressing a wound thoroughly wash the hands in some disinfectant. Wounds heal by granulation. First cut away all hair from the lips of the wound and thoroughly wash out the wound with tepid water with a little Condy's fluid in it.

Punctured wounds should be explored by means of a probe to find out the exact extent of the injury, and should be thoroughly washed out with a syringe.

In incised wounds, after thoroughly cleansing and dusting with Boric acid, the lips of the wound should be brought together with sutures and bandaged so that the dog cannot tear out the stitches.

The wound must be constantly washed and kept clean, and if it is a severe wound it should be dressed twice a day. Only dry dressing should be used. If proud flesh appears apply Nitrate of Silver.

In punctured wounds great care must be taken to heal from the bottom and keep the surface wound open. If the wound is allowed to heal from the top free drainage will be stopped and the pus will borrow along the muscles and abscesses will form.

If the wound is not a very deep one, blow in Boric powder with a quill, but if it is too deep for this, inject Boric lotion and bandage it.

If wounds have been neglected, it is by no means uncommon in Ceylon to find maggots have got into them. These may be got rid of by injecting 1 part Spirits of Turpentine, and 5 parts Coconut oil into the places where the maggots are.

DYSENTERY.

Symptoms.—Frequent stools with great straining, the evacuations are most disagreeable and are liquid with mucus and more or less tinged with blood, or blood alone may be passed.

The nose is hot and mouth dry, loss of appetite, and colicky pains increased by pressure. High temperature.

Treatment.—If taken in time dysentery generally yields readily to treatment. Keep patient warm and dry and give complete rest. The slightest exercise will aggravate the disease.

Give a dose of Castor-oil with about 10 drops of Laudanum in it. If pain is severe give a dose of 10 to 60 drops of Laudanum after the bowels have moved freely. Give 2 drops of Creasotum made into a pill with crumbs of bread three times a day.

The food should consist of Beeftea, egg and milk, malted milk, Bovril, Brand's essence of beef, etc. No solid food of any kind should be given.

MAMMITIS

(Inflammation of the milk glands) occurs frequently. The causes are generally the retention of milk, the result of taking away the puppies too soon or from their death, or cold.

Symptoms.—Redness and tenderness of the glands, the milk is curdled and often blood-stained, and in bad cases there is a discharge of pus.

Treatment.—On the first symptoms, foment the parts frequently with warm water, taking care to thoroughly dry them afterwards. If the bitch has lost her puppies the milk must be frequently drawn away by hand.

Give 1 dr. to 2 dr. Epsom salts with from 10 (ten) grs. to 20 grs. Bicarbonate of Soda twice a day in water until the bowels are well relaxed. If there are no sores rub the teats with Salad oil and Gin mixed in equal parts.

If abscesses form the contents must be evacuated by lancing and Boracic lotion applied two or three times a day.

CANKER OF THE EAR.

There are two forms of canker, parasitic and non-parasitic. The latter is by far the most common.

PARASITIC CANKER

is due to a very minute parasite. They differ from the mites of Mange in not burrowing under the skin, but live on the surface of the skin lining the passage into the ear. They do not live on the skin of the body or even of the flaps of the ear.

Symptoms.—Shaking of the head, continuous scratching with hind foot, carrying of the head on one side. In bad cases there is considerable pain. A dark waxy secretion is always present. If there is much wax present the ear should be syringed out with 1 part Methylated spirit in 10 parts of warm water.

Treatment.—Mr. A. J. Sewell, M.R.C.V.S., who first discovered the parasite in 1891 recommends the following treatment:—Ointment of Nitrate of Mercury 1 dr., oil of sweet almonds 1 oz., mixed, to be applied with a camel hair brush, or a few drops poured into the ear. The mixture should be used when freshly made.

NON-PARASITIC CANCER.

Symptoms shown are similar to those in the parasitic form except that there is an offensive discharge from the ear that varies considerably in colour—from a dirty grey or brown to almost black, and in bad cases is blood-stained.

Treatment.—Goulard's extract of lead 1 oz., Glycerine $\frac{1}{2}$ oz., olive oil $4\frac{1}{2}$ oz., mix the extract of lead and Glycerine first, and add the oil gradually, rubbing together in a mortar. The bottle must be well shaken before the liniment is used. Pour a little into the ear and hold the dog's head on one side until the liquid finds its way into the ear.

In all cases of canker a purgative should be given, and the diet must be light.

J. B. COLES.

NOTES ON THE CARE OF HORSES.

BY C. C. WILSON.

Before buying a horse, a comfortable stall ought to be provided, with a good floor. The best size is 12 ft. x 14 ft. which will either take a horse or a pony, and the best floor is one made of 2 parts anthill clay and one part sand, well stamped in, and with a slope of one inch from either side to the centre of the stall and the same from back to front of the stall, so as to run the water off. If the roof is iron, plenty of bedding should be kept under this, on reapers or jungle sticks placed across the tops of the walls, to keep the stall cool in the daytime.

One must watch a Horsekeeper pretty often, to see that he dresses, or cleans, the horse properly, first a good hand rubbing, then a good brushing, and the H. K. should be made to keep all hair that he gets out in hand rubbing, so that one knows whether he is doing his work or not. A tin should be kept in the stable for this purpose, and the hair burned daily after inspection; if a horse shows a long heavy coat, the H. K. is not doing enough hand rubbing, or the horse has turned a dry sweater, if the latter give plenty of grass and boiled food.

FEEDING

should be as regular as possible, and the evening feed as late as possible, as the horse has to go a good 12 hours during the night without food. The best food for any horse is oats, bran and chaff, 2 or 3 measures oats, 2 of bran, and 1 of chaff, 1 oz. of salt at a feed. Hacks should have on Monday, Tuesday, Thursday, Friday and Sunday; $1\frac{1}{2}$ measures crushed barley, and $\frac{1}{2}$ measure of crushed linseed boiled together

until soft, and there is a skin of oil on the surface, then mixed for the evening feed with 3 measures of bran, 2 of chaff and 1 oz. of salt. On Wednesday and Saturday give instead, a bran mash with 1 oz. of Epsom salts in it, and add (one) measure of chaff to make the horse masticate the food. A sackful of grass per day is not too much, a horse can easily do with more. It should be given as dry as possible, i.e. free of rain water, and during wet weather should be cut two days before wanted, and laid out on a trestle of warriches or reepers, to allow the water to drip off. When a horse eats his bedding, give him more grass. If he has plenty of grass he will not eat much bedding, but when adding clean bedding, put it underneath, and the old bedding on the top; by drying the bedding as often as possible, one can always have a stock of dry, soiled bedding, and the better the drainage of the stall the longer bedding will last.

It is essential that a horse should have some bedding under him during the daytime, and not only at night, for unless in extremity he will not pass urine if there is only a bare floor under him, as a horse greatly objects to splash on his legs, and this holding up urine will in time injure him internally.

Soaked gram should *never* be given in the feed, because H. K.s often do not soak the gram sufficiently, which causes colic by the formation of gas in the stomach, crushed gram can be had from all Horsefood dealers.

TACKLE.

In cleaning saddles and bridles the chief thing out here is to see that the H. K. undoes all buckles and washes the leather with soap and water before putting on the dubbing or saddle polish. If allowed they will rub on dubbing or polish on top of the dirt, to save themselves trouble, consequence is, sticky reins and dirty hands and breeches for Master.

AILMENTS.

Commonest are, mange, thrush in the feet, colic and worms. For mange coconut oil, kerosine and sulphur mixed into a thin paste and rubbed on to the effected parts after they have been washed with hot water and soap, and again washed every other day and the paste applied until cured, but I have not found the outward dressing do much good unless $\frac{1}{2}$ oz. of sulphur is given in each feed, for 2 or 3 weeks this seems to kill the parasite in the blood.

THRUSH.

The feet should be kept as dry as possible and the cleft of the frog cleaned out twice a day, with a thin flat piece of wood wrapped round with cotton wool, and dipped in strong Permanganate of Potash and

push into the cleft several times and clean out as well as possible, then pack the cleft with common salt closing it with a packing of cotton wool or tow, and to make it fairly waterproof give a good coat of Stockholm tar above the C' wool or tow, but for a horse liable to thrush a dry stable floor is an absolute necessity. A little turpentine and sweet oil, equal parts, occasionally dropped into the cleft is very effective in hardening the frogs and preventing thrush.

COLIC.

If slight, a bottle of beer (hot) with a teaspoonful of powdered ginger in it, care to be taken that the beer is not too hot. If the stomach is distended, showing the presences of gases, give $\frac{1}{2}$ lb. of Epsom salts and 1 oz. of Bicarbonate of Soda in 2 bottles of warm water. If this is ineffectual an enema of warm soapy water, with a bottle of *raw* linseed oil in it, enough to make about half a pailful. If one has not got a horse enema syringe, a substitute can be made out of a small bamboo, the end to be inserted to be *very carefully smoothed* and well grease with vaseline, the piston can be made of a stick with a piece of cloth or tow wrapped round the end until it fits the bamboo tightly. Never give *boiled* linseed oil to a horse or any other animal. It coats the stomach like varnish and is certain death.

WORMS.

Very common. Papaw leaves minced up very small and mixed with the food keeps them moving. In a bad case Harvey's worm powders are as good as anything. A good worm powder is 2 drs. Tartar Emetic, 4 drs. powdered nitre, in a bran mash twice a week for two or three weeks. Before physicing a horse, he should be prepared, by giving him bran mashes for at least 48 hours, and a muzzle kept on to prevent him getting at any solid food or his bedding.

SORE BACKS.

Goulard's Extract 2 ozs., olive oil 4 ozs., Fuller's earth 1 oz., that is if the skin is broken. If not broken but only swelled, foment with hot water and apply the following lotion, 1 bottle of vinegar with 1 oz. sugar of lead added to it and well shaken. A good lotion for cuts or wounds is, Goulard's Extract 4 ozs., Tincture of Benzoin 4 ozs.

HEAVY COLDS AND CHILLS.

Put the horse on to bran mashes with $\frac{1}{2}$ oz. of nitre mixed in each, and as much grass as he will eat.

Not nearly enough attention is paid to rugging horses in Ceylon. In the low-country a cotton sheet with a split up sack on top on cold nights is enough. Cotton sheets should not be allowed up-country, a good thick woollen rug in the daytime, and two at night are necessary in Nuwara Eliya. At rather a lower elevation, one thick rug and a splitsack may be sufficient, every horse should have a waterproof rug for the wet weather, the best are the waterproofed heavy khaki, as it does not crack or split.

Every horse owner should have by him, VETERINARY NOTES for HORSEOWNERS, by Captain Horace Hayes.



BOOK-KEEPING.

DOUBLE ENTRY.

THERE IS ONLY ONE SYSTEM OF BOOK-KEEPING AND THAT IS DOUBLE ENTRY: Double Entry is based on the fact that every transaction recordable in accounts has two aspects that one involving the receiving of a benefit by an account, and the other the giving of that benefit by another account.

There is no such system as Single Entry. Avoid Single Entry as carefully as the plague.

DEBIT AND CREDIT.

The account receiving the benefit is *Debited*.

The account giving the benefit is *Credited*—thus for every debit there must be a credit.

For instance, if Mye Estate receives cash from Be Estate—the entry is dealt with in Mye Estate books by crediting Be Estate Account and debiting Cash Account, because, Be Estate gives the benefit and Cash Account (in Mye Estate books) receives the benefit.

Always remember that it is accounts with which the entries deal—not persons.

The result of Double Entry is that at any given time a complete record of both the Impersonal as well as the Personal aspect of every dealing can be ascertained.

ADVANTAGES OF DOUBLE ENTRY.

Every Debit must have a Credit, therefore if at any given date all balances are extracted the debit balances must equal the credit balances. If this is so, the arithmetical correctness of the accounts is proved. If it is not so, then the error must be traced.

PROFIT AND LOSS STATEMENT.

As the Impersonal aspect of all transactions is recorded, the balance on Impersonal Accounts, when collected into a statement called the Profit and Loss Account, show whether a profit or loss has been made during the period. Debit balances appear on the debit side of the Profit and Loss Account and represent either losses or expenditure chargeable against Income; credit balances appear on the credit side of the Profit and Loss Account and represent either profits or receipts relating to Income.

IMPERSONAL ACCOUNTS.

By Impersonal Account is meant all accounts which do not relate to any individual or Company, such as Stationery Account, Rubber Sale Account, etc.

PERSONAL ACCOUNTS.

Personal Accounts are those which record transactions with an individual or Company, such as *John Smith's Account*, *General and Accidental Rubber Co's Account*.

ESSENTIAL BOOKS.

The essential books for Double Entry are:—Bank Book, Cash Book, Journal and Ledger.

BANK BOOK.

This book records all transactions in connection with the Bank, i.e. all amounts paid into the Bank appear on the debit side (left-hand side) and all cheques drawn appear on the credit side (right-hand side). This book should be written up from the Bank paying-in slips (debits) and the cheque book (credits), and should be agreed with the Bank Pass Book periodically. *On no account should this book be written up from the Pass Book.*

CASH BOOK.

This book records all dealings in connection with cash, i.e. all cash received, from whatever source, is entered on the left (Debit) side, and all cash paid out on the right (Credit) side.

Cash in this instance includes:—Cash, Money Orders, Postal Orders, etc., i.e. any equivalent of money other than cheques (which as we have seen above, pass through the Bank Book).

It is a very usual practice to combine the Bank Book and Cash Book in one book called the Cash Book, by having columns ruled for Bank and Cash; but from our experience this usually leads to confusion owing to Bank items getting into the Cash column, and Cash items getting into the Bank column, and we strongly advise keeping two separate books as enumerated above.

It is advisable, wherever practicable, to pay *all* moneys received into the Bank.

Do not journalise Bank or Cash transactions; it is a bad habit and often leads to confusion.

THE JOURNAL.

No entry should be made in the Journal without a sufficient explanation of its *raison d'être*. If this be neglected much time may be lost in tracing the origin of an entry which one requires to turn up after some time has elapsed. The form of the journal is given on pages 385-386.

The Journal is used for the purpose of collecting and distributing all entries other than those which concern Bank and Cash transactions, which latter pass through the Bank and Cash Books, as described above.

Example.—During January you (A.B.) buy from John Smith 10 bushels rice Rs. 50, 1 long chair (private account) Rs. 10, 10 tons manure Rs. 500, but you do not pay for same at the time. To record the transaction you make an entry in your Journal.

| | | Dr. | Dr. | Cr. |
|-------------------------|---|-----|-----|-----|
| January 31st - Sundries | | | | |
| | To John Smith | | | 560 |
| | being sundry purchases during the month as | | | |
| | per account dated 21/1/18 | | | |
| | Rice Account 10 bushels rice | Dr. | 50 | |
| | A. B.'s Account 1 long chair | | 10 | |
| | Expenditure Account (manuring) 10 tons manure | | 500 | |

Each of these items is then posted to its respective account. John Smith being credited with Rs. 560 and the other accounts debited with the respective sums making up this Rs. 560. When John Smith is paid (by cheque) the amount owing to him the Bank Book is credited with the amount and John Smith's account is debited.

In journalising, the entry must be considered from the following stand points:—

1. Which accounts are concerned?
 2. Which of these is to be debited and which to be credited?
- The account which receives the benefit must be debited.
The account which gives the benefit must be credited.

Every record should be self-explanatory, so that at a future date, and to anyone, the nature of the transaction can be readily perceived.

Do not journalise Bank or Cash transactions, it is a bad habit and often leads to confusion.

THE LEDGER.

No entry must ever be made in the Ledger unless it has first passed through a book of prime entry, i.e. Bank Book, Cash Book or Journal.

Ledger accounts fall under the following headings :—

- (1) Personal Accounts.
- (2) Impersonal Accounts.
- (3) Real Accounts.

1. Personal Accounts refer to dealings with Persons or Companies.
2. Impersonal Accounts record transactions affecting the estate, and not persons, such as Expenditure Account, Rubber Sales Account, Stationery Account.

Accounts which are concerned with the making of Profits or Losses, such as Rice Account, Rubber Account, Tea Account, etc., are known as "Revenue Accounts," and at the end of the financial year the balances on these accounts are transferred to the Profit and Loss Account.

3. Real Accounts record transactions affecting the more or less permanent assets of the estate, such as Buildings, Plant and Machinery, and Tools.

THE CHECK ROLL.

The Check Roll should be a complete summary of

- (a) The cooly and his personal dealings as far as they affect the estate, in other words a Debit and Credit account for each cooly, and
- (b) Therefore a complete record of the accounts of the labour force.

There are different forms of Check Roll, but the principle is the same in every case. A usual form for those who desire to adhere to the old book system is shown on page 390. The much more satisfactory method is the Macadam System explained elsewhere.

THE CHECK ROLL AND ADVANCES.

The method of dealing with the Check Roll and Advances should be as follows :— All advances of cash during the month should be debited to a Cash Advance Account as and when they are made and *inter se* credited in the Cash Book.

At the end of the month the Check Roll should be added up and the average rate of pay ascertained. This is done as follows :— Multiply the number of coolies by the number of days worked and divide the result into the total amount due to the coolies as per the Check Roll.

Suppose there are fifty coolies on the estate and they have each worked 25 days during the month, if we multiply 50 by 25 we find that the equivalent is 1,250 coolies for one day. Assuming that the total pay amounts to Rs. 500 for the month, by dividing this Rs. 500 by 1,250 we find that the average rate of pay is cents 40 per day.

The total of the Check Roll should then be journalised, *i.e.* the Check Roll Account in the Ledger should be credited with Rs. 500, and Estate Expenditure debited with such sum under the respective headings of Expenditure as is shown by the Distribution of Labour Book, *i.e.* Rubber Weeding 40 coolies @ 40 cents = Rs. 16-00, Rubber Tapping 60 coolies @ 40 cents = Rs. 24-00, etc., etc.

In the case of lent labour, the Estate to which the labour was lent should be debited with the value of such labour instead of Expenditure Account.

Cash Advances and Rice Advances recovered from the coolies' pay at the end of the month should then be credited to their respective Accounts and debited to the Check Roll Account. After the coolies have been paid and the balance of pay has been debited to the Check Roll Account both sides of his account should agree.

THE POCKET CHECK ROLL.

The Pocket Check Roll is a memorandum book for use in the field and for recording the daily "name" of each cooly.

The usual form is as shown on page 393.

At the end of the day a summary should be made showing the distribution of the labour, *i.e.* :—

| | | |
|----------------|-----|------------|
| Rubber Weeding | ... | 50 coolies |
| Do. Tapping | ... | 40 „ |
| Do. Manuring | ... | 20 „ |

The summary is entered up daily in the Distribution of Labour Book. The "names" of coolies are also written daily, into the big Check Roll from this book.

DISTRIBUTION OF LABOUR BOOK.

This book contains a daily summary of how the labour on the estate has been employed. It has 31 columns running vertically across the page, representing each day of the month, also one column for the total and one column for the cost, and horizontally down the page are written the Report headings, over which the labour has been distributed. This book is written up daily from the Pocket Check Roll and the result must correspond exactly with the Check Roll in all particulars, *i.e.*, daily total, monthly total, and total cost.

The most important books of record on the estate are the Check Roll and Distribution of Labour Book, as these form the basis for a large number of the entries which are subsequently put through the books of account. As the reader is probably well acquainted with these two books, being the first books with which he has to deal on an estate it is not proposed to make more than a passing remark upon them, as this article is more concerned with the books of account.

TRIAL BALANCE.

As soon as all the closing entries have been made in the Ledger, it is advisable to prove the arithmetical correctness of the books before preparing the Balance Sheet and Profit and Loss Account. To do this it is only necessary to extract *all* the balances from the Ledger, the debit balances in one column (the left-hand column) and the credit balances in another column (the right hand column), and if the books are correct the total of the debit column *must* agree with the total of the credit column (*as every debit must have a credit*).

This list of Balances is called the *Trial Balance*.

Note.—Remember that the balances on the Bank Book and Cash Book must be brought into the Trial Balance, as these are actually Ledger Accounts, although they are kept in separate books for the purposes of convenience.

BALANCE SHEET.

A Balance Sheet is a classified collection of all the balances remaining in the Ledger or Ledgers, after transferring to the Profit and Loss Account, those balances which refer to Revenue Receipts and Expenditure (Rice account, Rubber Sales account, etc.) Before preparing a Balance Sheet and Profit and Loss Account at any given date it is necessary to make entries in the books for all outstanding liabilities (i.e., liabilities which have not been discharged before the date of the Balance Sheet), and all outstanding Assets (such as Rubber unsold at date of Balance Sheet, etc.)

The Balance Sheet shows on the right-hand side the Assets of the Estate (Buildings, Machinery, Plant, Debtors, Stock, etc.), and on the left-hand side the Capital and Liabilities of the Estate. The difference between the Assets and Liabilities is the Profit or Loss for the period and must correspond with the balance on the Profit and Loss Account.

ACCOUNT CURRENT.

The mere mention of the name Account seems to strike terror into the hearts of most S. D.'s. Don't be alarmed, there is nothing magical in the name.

The Account Current is simply another name for the Company or Proprietors or Agents who employ you and finance the Estate.

In order to dispel all fears, write in pencil in the Ledger after the words "Account Current," the name of the Company or Proprietors by whom you are employed, and deal with the account in the same way as if you were dealing with any business house, such as Walkers or Browns, i.e., credit the Account Current with all cash, rice, manure or goods received from your employers, and debit them with the total expenditure for the month. Any moneys received on the Estate for the sale of Tea or Rubber, or amounts recovered in connection with Coast Advances must also be credited to Account Current, at the end of each month, as these items are dealt with in the Company's book at Head Office. Money Advanced in connection with Coast Advances must be debited to Account Current at the end of the month for the same reason.

The Account Current on the monthly report corresponds to the Superintendent's account in the Agents' Books or Head Office Books, and in order to arrive at this result, all that it is necessary to do is to exactly reverse the account as it appears in your (the Estate) Books, i.e., copy the credits in the Ledger Account on the debit side of the Account Current in the monthly report, and *vice versa*, copy the debits in the Ledger Account on the credit side of the Account Current in the monthly report.

COAST ADVANCES.

These consist of advances given to coolies to persuade them to leave their coast and come to an estate to work. When coolies transfer from one estate to another they are given a discharge (tundu), and the estate that engages them pays off their indebtedness to their late employers. This account is usually dealt with in the Head Office Books, therefore the total amount of advances each month is transferred to the debit of the Account Current, and the total amount recovered from the coolies each month is transferred to the credit of the Account Current. It is necessary for the Superintendent to keep a record showing the details of the Coast Advances outstanding, under the names of the various kanganies.

EXPENDITURE ACCOUNT.

This account is debited with all items of expenditure in connection with the estate, which are apportioned over the various headings of Expenditure appearing in the monthly report. The expenditure for the month, as per the monthly report is an exact copy of this Ledger Account, analysed over the various headings shown on the Report.

MONTHLY REPORT.

There is no need to dilate upon this, as every Company has its own printed form. Remember these points—

The Expenditure for the month corresponds to the Expenditure Account in the Ledger, and the total is debited monthly to the Account Current.

The Account Current is an exact copy of the Ledger Account of that name, only, *the items are reversed*, namely, the debits in the Ledger Account appear as credits on the Report, and *vice versa*, as explained previously.

The Balance Sheet is a collection of all the balances remaining in the Ledger, after the necessary transfers to the Account Current have been made.

The Rice Account is a summarised copy of the account under that name in the Ledger.

Coast Advances Account is a summary of the advances, recoveries and total indebtedness of the coolies, and agrees with the records kept for the purpose.

DEPRECIATION.

The general and most usual method of dealing with Depreciation is to write off in each year a fixed percentage of the diminishing value of each fixed Asset. Thus if Machinery account stands as follows on January 1st, 1918. To balance (*i.e.*, value of machinery now in use) Rs. 10,000, and on September 1st you add one Gas Engine, Rs. 4,500, the total value will be Rs. 14,500. On December 31st you write off 10% (estimating the life of your machinery at ten years), which leaves your balance on January 1st Rs. 14,500, less 10% = 1,450, or Rs. 13,050.

Note.—All Repairs and Renewals must be written off against Revenue (*i.e.*, transferred to Profit and Loss Account at the end of the period), and must on no account be added to the Capital value of the Asset. Only *additions* may be added to the Capital value of the Asset.

The soundness of this method lies in the fact that at the commencement when repairs and renewals are few, the Depreciation written off is heavy, whilst as time goes on and the repairs and renewal become heavier, so the Depreciation becomes lighter, which has the effect of partially equalising the amounts written off in each year. Thus in the above case the amounts written off would be as follows: repairs being estimated only:—

| | DEPRECIATION. | | | REPAIRS & RENEWALS | |
|----------|---------------|----------|-----|--------------------|---------|
| 1st year | Rs. | 1,450-00 | ... | (say) | Nil |
| 2nd „ | „ | 1,305-00 | ... | „ | Rs. 100 |
| 3rd „ | „ | 1,174-60 | ... | „ | „ 250 |
| 4th „ | „ | 1,057 05 | ... | „ | „ 400 |
| 5th „ | „ | 951 34 | ... | „ | „ 450 |

Thus, while the repair bill is nil, the amount written off is higher than when repairs and renewals have to be paid for.

INTERNAL CHECKS.

To place accounts on a thoroughly scientific basis every possible precaution must be taken to guard against—

(A) Intentional fraud ;

(B) Error or loss occasioned by carelessness on the part of a clerk.

It is generally admitted that the most successfully run offices are those which have had devoted to them the greatest amount of care, thought, and system, in the regulating of internal checks.

The certainty of a discrepancy being discovered at the end of the month is one of the most potent moral checks.

Wherever possible, *all* cash received should be paid into the Bank, all amounts over Rs. 10 should be paid by cheque and a receipt should be obtained for every payment. The cash balance should be agreed daily.

A counterfoil receipt book should be kept by the Superintendent, under lock and key, a receipt should be granted for all moneys received.

Clerks should on no account be allowed to grant receipts for moneys received.

GENERAL REMARKS AND MAXIMS.

Coolies' wages are computed by multiplying the rate of pay (which is fixed according to local conditions, and the value of the cooly) by the number of days' or half days' attendance.

Always total in pencil and check the addition before inking.

Never scratch out an entry. This may create suspicion. Always rule an incorrect entry through and let it remain for all to see.

MAXIMS.—Remember to date every item.

Write the headings of every account boldly and legibly.

Always insert the totals of each side of an account on a level with one another.

IN WRITING CHEQUES.

In filling up a cheque, care should be taken to make the wording quite distinct and compact, so as not to admit of the improper insertion of figures or addition of words, not intended by the drawer, such as the

alteration of 6 into 60, "Eight" into "Eighty," and so on. In case the drawer desires an alteration in a cheque after it is written out, either in date, amount, or name, such alteration should be made as clearly as possible and must always be initialled by the drawer.

A cheque payable to "Bearer" and not crossed is termed "open" and may be cashed by *any person* presenting it at the Bank on which it is drawn.

If crossed thus—

& Co.,

the value can only be obtained by passing it through a Bank account ; if thus—

Bank of Madras,

with the name of a *special* Bank, it will only be paid *through that Bank* ; and if the name of the person who is entitled to receive payment is added, thus—

*Bank of Madras,
a/c Thomas Jones,*

payment can be obtained only through that particular Bank and by that particular person. If a cheque is crossed thus—

*& Co.,
not negotiable,*

it will only be paid when presented through a Banker, and a person who takes a cheque so crossed does not receive, and cannot give, a better title to the cheque than that which the person from whom he received it had.

"Order" cheques may be crossed in the same way as "Bearer" cheques, with the same results.

Cheques payable to "Bearer" require no endorsement at the back. But if the word, "Bearer" be crossed through or if the word "Order" be inserted in the place of "Bearer," the person in whose favour it is drawn must endorse it, as hereafter directed for "Order" cheques, before it can be cashed.

A cheque payable to "Order" must, before presentation for payment, be endorsed (or signed on the back) by the person in whose favour it is drawn, and the endorsement must agree precisely with the name on the face of the cheque, even though the name there written is incorrect.

Cheque books should always be kept under lock and key.

Receipts should be granted from a printed book containing a duplicate.

IN ACCOUNTING.

To check your results in making an addition, add together the digits of each member of the addition, and, by adding again, reduce the digits of these sums to single digits. Adding these single digits together reduce the resulting sum to a single digit. Then add together the digits of the answer to the problem. Reduce this to a single digit. This latter will be the same as the single digit obtained by the first process, if the addition has been correctly done. For example:

| | | |
|--------|-------------|--------|
| 45713 | 20 | 2 |
| 64781 | 26 | 8 |
| 96321 | 21 | 3 |
| 78425 | 26 | 8 |
| 48973 | 31 | 4 |
| 64819 | 28 = 10 = 1 | |
| <hr/> | | |
| 399032 | = 26 = 8 | 26 = 8 |

This short cut is a safer way of checking the result than the usual method of going over the addition of a column of figures the second time, in an opposite direction.

ADDITION.

Figures of three or four digits may be easily added, without making a calculation on a pad, when they appear where pencil marks cannot be made. A mathematical expert explains that when he first tried to do this he began the addition of two columns at a time. Later, this was expanded to three, then four, and now he adds any and all numbers in this manner.

For example, to show the process that must be followed by the beginner, suppose the addition is:

2,322
9,834
610

The beginner adds 2,322 and 9,000; then adds 800 to the 11,322; to the 12,122, he adds 30 and to the 12,152, he adds 4; to the 12,156 he adds 600 and to the 12,756, he adds 10 and the total is 12,766. *With a little practice such a sum can be done in a fraction of the time it takes to tell about it or read it. It is possible to add the 2,322 and 9,800, then to handle the 34 and the 610 with two more operations. The operations can be reduced further and further with consistent practice.

TO OPEN A SET OF BOOKS.

Assume that you, Bill Smith, are appointed Superintendent of Suffolk Estate as from the 1st January, 1918. Upon taking charge all the books, papers, etc., are handed over to you, together with the Cash and Rice on hand, and a copy of the Balance Sheet as appearing on the December Monthly Report.

The Balance Sheet is as follows :—

| Liabilities. | | Balance Sheet, 31st December, 1917. | | Assets. | |
|---|-------|-------------------------------------|--|---------|-------|
| | Rs. | c. | | Rs. | c. |
| Check Roll. Balance of pay due coolies ... | 1,750 | 00 | Account Current. Balance due to Superintendent ... | 485 | 00 |
| Billinggate Estate. Due for borrowed labour ... | 100 | 00 | Bank Account. Balance at Bank ... | 2,000 | 00 |
| Abram Saibo. Balance due for supplies, etc. ... | 1,200 | 00 | Cash Account. Cash on hand ... | 500 | 00 |
| Supermanian Chetty. Balance due for rice ... | 100 | 00 | Rice Account. Rice on hand 20 bushels ... | 100 | 00 |
| J. Jones, Dec. Salary ... | 150 | 00 | Smithfield Estate. Due for Lent Labour ... | 200 | 00 |
| | | | Cash Advances a/c. Balance not recovered | | |
| | | | Appu Hamy 10 ... | | |
| | | | Singo „ 5 ... | 15 | 00 |
| | Rs. | 3,300 | 00 | Rs. | 3,300 |
| | | | | 00 | |

The first thing to be done is to check the balances of Cash and Rice on hand and agree the Bank Balance with the Pass Book.

Then we will assume that either, no books of account have been handed over to you, or you wish to open a new set of Books.

The above balances are what you have to start your books with on the 1st January, 1918, and, in order to do this, take your Journal and make the following entry.

| | | Dr. | | Cr. | |
|---|--|-------|--------|-------|-------|
| | | Dr. | Rs. c. | Rs. | c. |
| 1918 Sundries. | | | | | |
| Jan. 1 To Sundries — | | | | | |
| Being opening balances on 1st January, 1918, as per Balance Sheet | | | | | |
| Account Current (Suffolk Estate, Colombo) ... | | 485 | 00 | | |
| Bank Book. Balance at Bank ... | | 2,000 | 00 | | |
| Cash Book. Balance on hand ... | | 500 | 00 | | |
| Rice Account do ... | | 100 | 00 | | |
| Smithfield Estate ... | | 200 | 00 | | |
| Cash Advances Account ... | | 15 | 00 | | |
| To Check Roll ... | | | | 1,750 | 00 |
| „ Billinggate Estate ... | | | | 100 | 00 |
| „ Abram Saibo ... | | | | 1,200 | 00 |
| „ Supermanian Chetty ... | | | | 100 | 00 |
| „ J. Jones ... | | | | 150 | 00 |
| | | Rs. | 3,300 | 00 | 3,300 |
| | | | | 00 | |

Having done this, post the balance at Bank to the debit of the Bank Book (see example Item 1) and the balance of Cash on hand to the debit of the Cash Book (see example Item 1), open accounts in your Ledger for each of the other items, posting the debit items to the debit of their respective Ledger Accounts and the credit items to the credit of their respective Ledger Accounts. Your books are now open and you can go ahead with the month's transactions.

EXAMPLE.—Your transactions during the month are as follows :—

| 1918 | | Rs. | cts. |
|--------|--|-----|----------|
| Jan. 2 | You receive a cheque from Agents for December balance. (see Bank Book Item (2)) | ... | 485-00 |
| „ 2 | You draw a cheque for cash on account of Wages (see Bank Book (7) and Cash Book (2)) | ... | 1,500-00 |
| „ 2 | You pay a cheque to Billingsgate Estate to settle balance due at end of December (Bank Book (8)) | ... | 100-00 |
| „ 3 | You pay (in cash) Coolies' balance of December Wages (cash Book (7)) | ... | 1,750-00 |
| „ 5 | You pay (in cash) Supermanian Chetty balance due at end December (Cash Book (8)) | ... | 100-00 |
| „ 7 | You receive from Agents a Debit Note for Rice, Manure, Pruning Knives, Agency Charges, etc. (Journal Entry (2)) | ... | 500-00 |
| „ 8 | You sell locally for cash 10 lbs. Tea (Cash Book (3)) | ... | 5-00 |
| „ 8 | You sell locally for cash 5 lbs. Rubber (Cash Book (4)) | ... | 20-00 |
| „ 9 | You pay a cheque to Abram Saibo on account (Bank Book (9)) | ... | 1,000-00 |
| „ 10 | You receive a cheque from your Agents (Bank Book (3)) | ... | 5,000-00 |
| „ 10 | You receive a cheque for 100 lbs. Tea sold during January (Bank Book (4)) | ... | 50-00 |
| „ 10 | You pay cash to a Weeding Contractor (Cash Book (9)) | ... | 100-00 |
| „ 11 | You receive from Abram Saibo timber for repairing factory and lines (journal Entry (3)) | ... | 200-00 |
| „ 12 | You receive from Supermanian Chetty 200 bushels rice (Journal Entry (4)) | ... | 1,000-00 |
| „ 12 | You receive cash from Head Kangany, repaying portion of Coast Advances (Cash Book (5)) | ... | 50-00 |
| „ 15 | You receive a cheque from Smithfield Estate in settlement of balance due by them at end December. (Bank Book (5)) | ... | 200-00 |
| „ 15 | You pay cash to J. Jones for December Salary (Cash Book (10)) | ... | 150-00 |
| „ 20 | You receive a cheque for 10 lbs. Rubber sold locally during January (Bank Book (6)) | ... | 40-00 |
| „ 20 | You draw a cheque for Cash (Bank Book (10), Cash Book (8)) | ... | 100-00 |
| „ 21 | You advance Cash to Coolies, S. Muttu, R10, Punchi R15 (Cash Book (11)) | ... | 25-00 |

| 1918 | Rs. cts. |
|--|----------|
| Jan. 28 You take over from "G" Estate a gang of coolies and pay "G" Estate a cheque for their indebtedness to that Estate (Bank Book (11)) 4,000-00 | |
| ,, 31 You make up your Check Roll and Labour Distribution Book and Journalize the total (Journal Entry (5)) 3,000-00 You make a Journal entry for salary and allowances due to you for the month (Journal Entry (6)) 500-00 You make a Journal entry for salary and allowances due to your S.D.—Jenkins—for the month (Journal Entry (6)) 300-00 | |
| You make a Journal Entry for Rice Issued during month 200 bushels (Journal Entry (7)) ... 1,000-00 | |
| You recover through the Check Roll Cash advances Appu Hamy R10, S. Hamy R5 (Journal Entry (8)) 15-00 | |
| You transfer to Account Current the Total Expenditure for month (Journal (9)) ... 4,450-00 | |
| You transfer to Account Current the balance on Tea Sales and Rubber Sales Accounts (Journal Entry (10)) 115-00 | |



JOURNAL

JANUARY, 1918.

Page 1.

| | | Dr. | | Cr. | |
|--------|---------------------------------------|------|------|------|----|
| | | Rs. | c. | Rs. | c. |
| 1918 | | | | | |
| Jan. 1 | (1) Sundries. Dr. | | | | |
| | To Sundries | | | | |
| | being opening balances on 1st | | | | |
| | Jan., 1913, as per Balance | | | | |
| | Sheet | | | | |
| | Account Current (Suffolk Es- | | | | |
| | tate Colombo) ... | 1 | 485 | 00 | |
| | Bank Book, Balance at Bank ... | BB 1 | 2000 | 00 | |
| | Cash Book, Balance on hand ... | CB 1 | 500 | 00 | |
| | Rice a/c do 20 bushels ... | 9 | 100 | 00 | |
| | Smithfield Estate Account ... | 4 | 200 | 00 | |
| | Cash Advance a/c. Appu Hamy | | | | |
| | 10/-, Singo Hamy 5/- | 11 | 15 | 00 | |
| | To Check Rolls/c. Dec. Bal- | | | | |
| | ance ... | 10 | | 1750 | 00 |
| | „ Billingsgate Estate ... | 6 | | 100 | 00 |
| | „ Abram Saibo ... | 6 | | 1200 | 00 |
| | „ Supermanian Chetty ... | | | 100 | 00 |
| | „ J. Jones ... | 8 | | 150 | 00 |
| „ 7 | (2) Sundries. Dr. | | | | |
| | To Account Current | 1 | | 500 | 00 |
| | being supplies received from | | | | |
| | Agents as per their Debit | | | | |
| | Note of this date. | | | | |
| | Rice Account, 20 bushels @ 5/- | 9 | 100 | 00 | |
| | Expenditure a/c. | | | | |
| | (Manure) 7 tons Manure @ | | | | |
| | 50/- | 14 | 350 | 00 | |
| | (Pruning) 2 doz. Pruning | | | | |
| | knives @ 20/- per doz. ... | „ | 40 | 00 | |
| | (Agency) Rly. Charges, etc. | „ | 10 | 00 | |
| „ 11 | (3) Expenditure Account (Repairs) Dr. | | | | |
| | To Abram Saibo. | 14 | 200 | 00 | |
| | being timber supplied for re- | 6 | | 200 | 00 |
| | pairing factory and lines, as | | | | |
| | per account dated 9-1-15. | | | | |
| | Factory Rs. 150 ... | | | | |
| | Lines „ 50 ... | | | | |

JOURNAL

JANUARY, 1918.

Page 2.
Cr.

| | | Dr. | | | |
|---------|-----------------------------------|-----|---------|------|----|
| | | Rs. | c. | Rs. | c. |
| 1918 | | | | | |
| Jan. 12 | (4) Rice Account Dr. | 9 | 1000 00 | | |
| | To Supermanian Chetty | 7 | | 1000 | 00 |
| | being 200 bushels of Rice | | | | |
| | purchased at Rs. 5/- per | | | | |
| | bushel as per Account dated | | | | |
| | 11-1-15. | | | | |
| .. 31 | (5) Sundries. Dr. | | | | |
| | To Check Roll Account | 10 | | 3000 | 00 |
| | being wages due for the | | | | |
| | month as per Check Roll | | | | |
| | Smithfield Estate a/c. Lent | | | | |
| | Labour 100 days | 4 | 50 00 | | |
| | Expenditure Account | 14 | 2950 00 | | |
| | Pruning 4000 days Rs. 2000... | | | | |
| | Weeding 1500 " " 750... | | | | |
| | Manuring 200 " " 100... | | | | |
| | Repairs 200 " " 100... | | | | |
| .. .. | (6) Expenditure a/c (Salaries and | | | | |
| | Allowances) Dr. | 14 | 800 00 | | |
| | To Sundries | | | | |
| | being Salaries and Allowan- | | | | |
| | ces for the month | | | | |
| | To Bill Smith. Salary 450/- | | | 500 | 00 |
| | allow 50/- | 2 | | | |
| | To Jenkins Salary 260/- allow | | | 300 | 00 |
| | 40/- | 3 | | | |
| .. .. | (7) Check Roll Account Dr. | 10 | 1000 00 | | |
| | To Rice Account | 9 | | 1000 | 00 |
| | being rice issued during the | | | | |
| | month as per list 200 | | | | |
| | bushels @ 5/- | | | | |
| .. .. | (8) Check Roll Account Dr. | 10 | 15 00 | | |
| | To Cash Advance Account | 11 | | 15 | 00 |
| | being Advances recovered | | | | |
| | through Check Roll | | | | |
| | Appu Hany 10/- Singo | | | | |
| | Hany 5/- | | | | |

Page 3.

| | | Dr. | | | |
|---------|------------------------------|-----|---------|------|----|
| | | Rs. | c. | Rs. | c. |
| 1918 | | | | | |
| Jan. 30 | (9) Account Current Dr. | 1 | 4450 00 | | |
| | To Expenditure Account | 14 | | 4450 | 00 |
| | transferring Expenditure for | | | | |
| | the month | | | | |
| Jan. 31 | (10) Sundries Dr. | | | | |
| | To Account Current | 1 | | 115 | 00 |
| | transferring the following | | | | |
| | balances. | | | | |
| | T-a Sales a/c. 110 lbs. | 12 | 55 00 | | |
| | Rubber Sales a/c. 15 | 13 | 60 00 | | |

LEDGER.

| Dr. | | | | | Account Current (Suffolk Estate, Colombo.) | | | | | Cr. | | | | | | | | | |
|--------|--|----|---|-------|--|--------|---------------------------------------|----|---|-------|----|--|--|--|--------|--|--|--|--|
| 1918 | | | | | Rs. c. | | | | | 1918 | | | | | Rs. c. | | | | |
| Jan. 1 | To Sundries. Balance at date | J | 1 | 485 | 00 | Jan. 2 | By Bank. Remittance | BB | 1 | 485 | 00 | | | | | | | | |
| " 26 | " Bank. Coast Advances 100 coo-lies taken on | BB | 1 | 4,000 | 00 | " 7 | " Sundries. Supplies, etc. | J | 1 | 500 | 00 | | | | | | | | |
| " 31 | " Expenditure Account. Total for month | J | 3 | 4,450 | 00 | " 10 | " Bank. Remittance | BB | 1 | 5,000 | 00 | | | | | | | | |
| | | | | | | " 12 | " Cash. Coast Advances recovd. | CB | 1 | 50 | 00 | | | | | | | | |
| | | | | | | " 31 | " Sundries. Tea sold locally 110 lbs. | J | 3 | 55 | 00 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | " 31 | " Rubber 15 lbs. | " | | 60 | 00 | | | | | | | | |
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Folio (2)

| Dr. | | Bill Smith's Account. | | | | Cr. | |
|---------|-------------------------|-----------------------|----|---------|--|-----|----|
| 1918 | | Rs. | c. | 1918 | | Rs. | c. |
| Jan. 31 | To Balance carried down | 500 | 00 | Jan. 31 | By Expenditure Account. Salary and allowance for month | 500 | 00 |
| | | | | | | | |
| | | | | Feb. 1 | „ Balance brought down | 500 | 00 |
| | | | | | | | |

| Dr. | | Jenkin's Account. | | FOLIO (3) | | Cr. | |
|---------|-------------------------|-------------------|----|-----------|---|-----|----|
| 1918 | | Rs. | c. | 1918 | | Rs. | c. |
| Jan. 31 | To Balance carried down | 300 | 00 | Jan. 31 | By Expenditure a/c. Salary & allow. for month | 300 | 00 |
| | | | | | | | |
| | | | | 1915 | | | |
| | | | | Feb. 1 | By Balance brought down | 300 | 00 |
| | | | | | | | |

| Dr. | | Smithfield Estate Account | | FOLIO (4) | | Cr. | |
|--------|------------------------------|---------------------------|----|-----------|--------------------------|---------|----|
| 1918 | | Rs. | c. | 1918 | | Rs. | c. |
| Jan. 1 | To Sundries. Balance at date | 200 | 00 | Jan. 15 | By Bank. Cheque received | 200 | 00 |
| „ 31 | „ Check Roll. Lent Labour | 50 | 00 | „ 31 | „ Balance carried down | 50 | 00 |
| | | Rs. 250 | 00 | | | Rs. 250 | 00 |
| Feb. 1 | „ Balance brought down | 50 | 00 | | | | |

| Dr. | | Billingsgate Estate Account | | FOLIO (5) | | Cr. | |
|--------|----------------------|-----------------------------|----|-----------|------------------------------|-----|----|
| 1918 | | Rs. | c. | 1918 | | Rs. | c. |
| Jan. 3 | To Bank. Cheque paid | 100 | 00 | Jan. 1 | By Sundries. Balance at date | 100 | 00 |
| | | | | | | | |

Dr.

Abram Saibe's Account.

Folio 6
Cr.

| 1918 | | | Rs. | c. | 1918 | | | Rs. | c. |
|--------|----------------------------------|-------|-------|-------|--------|------------------------------|---|-------|-------|
| Jan. 9 | To Bank. Cheque on B. B. account | B. B. | 1,000 | 00 | Jan. 1 | By Sundries. Balance at date | J | 1,200 | 00 |
| " 31 | " Balance carried down | | 400 | 00 | " 11 | " Expenditure a/c. Timber | J | 200 | 00 |
| | | | Rs. | 1,400 | 00 | | | Rs. | 1,400 |
| | | | | | Feb. 1 | " Balance brought down | | | 400 |

Dr.

Supermanian Chetty's Account.

Folio 7
Cr.

| 1918 | | | Rs. | c. | 1918 | | | Rs. | c. |
|--------|---|----|-------|-------|--------|------------------------------|---|-----|-------|
| Jan. 5 | To Cash. In settlement December balance | CB | 100 | 00 | Jan. 1 | By Sundries. Balance at date | J | 100 | 00 |
| " 31 | " Balance carried down | | 1,000 | 00 | " 12 | " Rice Account. 200 bushels | J | 2 | 1,000 |
| | | | Rs. | 1,100 | 00 | | | Rs. | 1,100 |
| | | | | | Feb. 1 | " Balance brought down | | | 1,000 |

Dr.

J. Jones' Account.

Folio 8
Cr.

| 1918 | | | Rs. | c. | 1918 | | | Rs. | c. |
|---------|--------------------------|----|-----|-----|------|--------|------------------------------|-----|-----|
| Jan. 15 | To Cash. December Salary | CB | 1 | 150 | 00 | Jan. 1 | By Sundries. Balance at date | J | 150 |
| | | | | | | | | | 00 |

Dr.

Rice Account.

Folio
Cr.

| 1918 | | | Rs. | c. | 1918 | | | Rs. | c. |
|--------|------------------------------------|---|-----|-------|------|---------|---------------------------------------|-----|-----|
| Jan. 1 | To Sundries Balance at date 20 bu. | J | 1 | 100 | 00 | Jan. 31 | By Check Roll Account. Issues 200 bu. | J | 2 |
| " 7 | " A/s Current. From Agents 20 " | J | | 100 | 00 | " | " Balance carried down | | 40 |
| " 12 | " S. Chetty 200 " | J | 2 | 1,000 | 00 | | | | 200 |
| | | | Rs. | 240 | 00 | | | Rs. | 240 |
| Feb. 1 | To Balance brought down 40 bush. | | | 200 | 00 | | | | 00 |

| Dr. | | CHECK ROLL ACCOUNT. | | | | | | Cr. | | |
|--------|-------------------|---------------------|-------|-------|--------|----------------------|---|-------|-------|----|
| 1918 | | | Rs. | c. | 1918 | | | Rs. | c. | |
| Jan. 3 | To Cash. December | C.B. | | | Jan. 1 | By Sundries. Balance | J | | | |
| | Balance | 1 | 1,750 | 00 | | at date | 1 | 1,750 | 00 | |
| „ 31 | „ Rice Account. | J | | | „ 31 | „ Sundries. Wages | J | | | |
| | Issues | 2 | 1,000 | 00 | | January | 2 | 3,000 | 00 | |
| „ 31 | „ Cash Advances | | | | | | | | | |
| | Account. Re- | J | | | | | | | | |
| | coveries | 2 | 15 | 00 | | | | | | |
| | „ Balance carried | | | | | | | | | |
| | down | | 1,985 | 00 | | | | | | |
| | | | Rs. | 4,750 | 00 | | | Rs. | 4,750 | 00 |
| | | | | | Feb. 1 | By Balance brought | | | | |
| | | | | | | down | | 1,985 | 00 | |

| Dr. | | CASH ADVANCES ACCOUNT. | | | | | | Folio 11 | | | |
|--------|----------------------|------------------------|-----|----|----|--------|--------------------|----------|-----|----|----|
| 1918 | | Rs. | | c. | | 1918 | | Rs. | | c. | |
| Jan. 1 | To Sundries. Balance | | | | | Jan 31 | By Check Roll. Re- | J | | | |
| | at date | | | | | | coveries | 2 | 15 | 00 | |
| | Appu Hamy 10 | | | | | | Appu Hamy 10 | | | | |
| | Singo | 5 | 1 | 15 | 00 | | Singo | 15 | | | |
| | | | | | | | Balance carried | | | | |
| | | | | | | | down | | 25 | 00 | |
| Jan 21 | „ Cash Advances | C. B. | | | | | | | | | |
| | Sulli Muttu 10 | 1 | 25 | 00 | | | | | | | |
| | Punchi | 15 | | | | | | | | | |
| | | | Rs. | 40 | 00 | | | | Rs. | 40 | 00 |
| Feb. 1 | Balance brought | | | | | | | | | | |
| | down | | | 25 | 00 | | | | | | |
| | Sulli Muttu 10 | | | | | | | | | | |
| | Punchi | 15 | | | | | | | | | |

| Dr. | | | | TEA SALES ACCOUNT. | | | | Folio 12 | | | | | | | |
|----------------------------|--|--|--|--------------------|--|--|--|------------------------------------|--|--|--|-----------|--|--|--|
| | | | | | | | | Cr. | | | | | | | |
| 1918 | | | | Rs. c. | | | | 1918 | | | | Rs. c. | | | |
| Jan 31, To Account Current | | | | J | | | | Jan 10 By Cash, 14 lbs. sold B. B. | | | | | | | |
| Transfer | | | | 3 55 00 | | | | J. Smith | | | | 1 50 00 | | | |
| | | | | | | | | ,, 8 ,, Cash, 10 lbs. on C. B. | | | | | | | |
| | | | | | | | | Estate | | | | 1 5 00 | | | |
| | | | | Rs. 55 00 | | | | | | | | Rs. 55 00 | | | |

| Dr. | | RUBBER SALES ACCOUNT. | | | | Folio 13 | | |
|--------|---------------------|-----------------------|-----|-------|--------|-----------------------|-------|-------|
| | | Rs. | | c. | | | Cr. | |
| 1918 | | | | | 1918 | | | |
| Jan 31 | To Account Current. | J | | | Jan 20 | By Bank. 10 lbs. sold | B. B. | |
| | Transfer | 3 | 60 | 00 | | S. Brown | 1 | 40 00 |
| | | | | | | | C. B. | |
| | | | | | " 8 | „ Cash. 5 lbs. sold | 1 | 20 00 |
| | | | | | | | | |
| | | | Rs. | 60 00 | | | Rs. | 60 00 |

TO EXTRACT A TRIAL BALANCE.

Having now completed the postings into the Ledger extract a Trial Balance, as follows, to prove the accuracy of the books.

| FOLIO. | | TRIAL BALANCE. | | 31st JANUARY, 1918. | | | | |
|--------|----|-------------------|-----|---------------------|-------|-------|-------|----|
| | | | | Dr. | | Cr. | | |
| | | | | Rs. | c. | Rs. | c. | |
| Bank | 1 | Bank Balance | ... | 1,075 | 00 | | | |
| Cash | 1 | Cash Balance | ... | 50 | 00 | | | |
| Ledger | 1 | Account Current | ... | 2,785 | 00 | | | |
| | 2 | Bill Smith | ... | | | 500 | 00 | |
| | 3 | Jenkins | ... | | | 300 | 00 | |
| | 4 | Smithfield Estate | ... | 50 | 00 | | | |
| | 6 | Abram Saiho | ... | | | 400 | 00 | |
| | 7 | S. Chetty | ... | | | 1,000 | 00 | |
| | 9 | Rice Account | ... | 200 | 00 | | | |
| | 10 | Check Roll | ... | | | 1,985 | 00 | |
| | 11 | Cash Advances | ... | 25 | 00 | | | |
| | | | | Rs. | 4,185 | 00 | 4,185 | 00 |

Having thus proved the accuracy of your books (the total debit balances agreeing with the total credit balances) you then proceed to copy the Account Current on to the Report, and to make up your monthly Balance Sheet by incorporating the above *debit* balances on the *Asset* side of the Balance Sheet and the above *credit* balances on the *Liability* side of the Balance Sheet.

CHECK ROLL.

© Check Roll, Copyright, Reserved by the Union of South America, Ltd.

| Payee's Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 | 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 | 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 | 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 | 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 | 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 | 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 | 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 | 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 | 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 | 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 | 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 | 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 | 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 | 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 |
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MACADAM'S SYSTEM FOR KEEPING COOLIES' ACCOUNTS.

The system I have to put before you has the advantage of not over interference on the part of the superintendent between kangany and cooly in the matter of their little dealings, which I think is of some importance, if the desire is to keep the kangany in authority over his coolies. It teaches the cooly, on the other hand, that his interests are being watched and periodically he knows the exact amount of his debt. The kangany, too, will also learn his responsibility towards the coolies in his gang, and that the system will keep them contented as far as the accounts are concerned.

The system is one of control of the accounts after the actual amount of individual or family debt has been ascertained. In the first place, therefore, if the accounts have not already been arrived at, it will be necessary to obtain them, and I suggest pass-books are issued to each cooly returnable on a certain day with the accounts entered, agreed between the parties and signed or thumb-marked by both.

From these pass-books would be taken the total and entered into the "Register of coolies' debts" against the individual or family and under the month in which the account has been agreed up to. After being checked by the superintendent it would be advisable to enter the balance on a clean page of the pass-book and the amount dated and initialled by him.

The pass-books should then be returned into the coolies' own hands to be retained and entered up by him from time to time, or not as he pleases.

Subsequent Control of the Accounts—Card A.—A kangany having a transaction with a cooly, or a head kangany with a sub kangany, as the case may be, would ask for a Card (A) and, after filling in the details agreed upon between him and his cooly, would together proceed to the superintendent or assistant and hand in the card. The superintendent, after satisfying himself the account is in order, will obtain the thumb-mark of the cooly's registered number, date and initial it and give the cooly a Card (B) duly filled up and signed by him.

The cooly will know from this Card (B) that his account is to be debited with the amount shown and can enter it if he wishes in his pass-book.

The Card (A) is retained by the superintendent and the amount debited to the cooly in the "Register" under the month of the transaction the cards being afterwards filed away in the numerical order, I suggest, so that it can easily be found in the event of any dispute arising in regard to the account or for any other reference to it required.

A suggestion is that it *should be well understood that no long outstanding accounts will be recognised.* [The judges comment on this sentence as "most important."] Cards should always be available and the account handed in during the month of the transaction.

In the case of credit entries in the "Register" such as recoveries from check-roll a Card (C) would be prepared and given to the cooly at the pay table, together with any balance of pay due to him.

This card also shows debt due by him at date of issue, and in the event of no recoveries of pay, a point should be made, say once in three months of preparing these cards showing the balance of debt due and handed to each cooly on pay day.

The system has the advantage of being simple and should entail the *minimum amount of work* that any system of keeping accounts of coolies can do, if kept in such a manner as to have them properly under control.

The "Register of coolies' accounts" is in a form that any account can at a moment's notice be arrived at, as well as the total of a gang.

It will be a simple matter too on referring to the Register to see whether the accounts are being kept up to date, a matter of some importance to the Visiting Agent, and in the case of a new superintendent taking over charge of an estate. Accompanying this description of the system, samples of the three cards mentioned, A. B. and C., are sent; these should be printed with the name of the estate and the district, and a copy of the "Register of coolies' debts" is also sent.

C. O. MACADAM.

CARD A.

Estate. *District.*

கடவுள் ஆள் பெயர்

Debtor's Name

பெரிய கங்காணி பெயர்

சில்லறை கங்காணி பெயர்

Head Kangany.

Sub-Kangany.

| Date. | சில்லறைப்பற்றம் வீபதம் DETAILS OF DEBITS. | ரூபா Rs. | சதம் cts. |
|-------|--|-------------|--------------|
|-------|--|-------------|--------------|

Debtor's

Thumb Mark.

Rs.

Registered No

Assistant's Initials.

Date

REVERSE OF CARD.

To be entered at Office :-

Debited to a/c No

Clerk's Initials

Date

CARD B.

*Your a/c has this day been debited with the
sum of Rs.*

(Tamil translation appears on the reverse.)

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CARD C.

*Your a/c has this day been credited with the sum
of Rs. and the balance due by you at the end of
the month is Rs.*

(Tamil translation appears on the reverse.)

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NOTES.

LEGAL, ETC.

LEGAL MAXIMS.

IGNORANCE OF THE LAW IS NO DEFENCE.
THE LAW WILL NOT COMPEL YOU TO DO WHAT IS IMPOSSIBLE.

TO CONCEAL A FRAUD, AND TO COMPOUND A FELONY ARE BOTH LEGALLY PUNISHABLE.

LEGAL HINTS.

(EXTRACTS FROM THE C. PROCEDURE CODE.)

Sudden Deaths.—(C. P. C. Sec. 21.) Every person aware of any sudden or any unnatural death or of death by violence or any death under suspicious circumstances, or of the body of any person being found dead without it being known how such person came by death, shall in the absence of reasonable excuse—the burden of proving which shall lie upon the person so aware—forthwith give information to the nearest police court or to the officer in charge of the nearest police station or to a peace officer or the headman of the nearest village of such commission or intention or of such sudden unnatural or violent death or death under suspicious circumstances or of the finding of such dead body.

Warrants.—(C. P. C. Sec. 19.) Every person is bound to assist a police magistrate or a peace officer reasonably demanding his aid in the taking of any other person whom such magistrate or peace officer is authorised to arrest. (C. P. C. Sec. 55.) A warrant of arrest may be executed at any place in this Island.

Detention.—(C. P. C. Sec. 37.) No peace officer shall detain in custody a person arrested without a warrant for a longer period than under all the circumstances of the case is reasonable, and such period shall not exceed twenty-four hours exclusive of the time necessary for the journey from the place of arrest to the police magistrate.

Summons.—(C. P. C. Sec. 44.) This must be in the language of the person summoned, unless he is believed to be able to read English.

Powers of Inquirers.—(C. P. C. Sec. 123.) An inquirer can compel the attendance of persons able to give information.

(C. P. C. Sec. 124.) An inquirer cannot administer any oath or affirmation.

Witnesses and Jurors.—(C. P. C. Sec. 257.) The qualification for an English-speaking juror is any one who can speak, read and write the English language, and each of whom possesses in his own or his wife's right an income of not less than Rs. 1,000 a year, or is in the enjoyment of a monthly salary of not less than Rs. 100.

Minute by the Governor.

Witnesses who attend the Supreme Court from a distance of five miles and under will not be entitled to batta or travelling expenses.

Witnesses residing over five miles and less than ten miles from the court-house will be paid their actual travelling expenses to and fro, but no batta will be allowed. Where public conveyance is not available, travelling expenses will be allowed according to the rates laid down in Schedules A and D.

Witnesses who attend the Supreme Court from a distance of more than ten miles shall be entitled to payment of batta and travelling expenses. Those residing in Western, North-Western, Southern, Central, and Uva according to the rates set out.

In calculating batta payable to witnesses who are not entitled to mileage, one day's batta shall be allowed for every ten miles fully completed and travelled, provided the journey is not performed by public conveyance or otherwise paid for.

All Europeans not in the service of Government and native planters, proprietors, and superintendents of all estates not less than 150 acres in extent in cultivation, which are situated more than ten miles from the sessions town, shall be entitled to a special rate of Rs. 7-50 per day when serving as jurors.

No batta is payable either to witnesses or jurors for days on which mileage is drawn.

(C. P. C. Sec. 268.) Unless it be unavoidable not more than one person belonging to or employed in any mercantile or business establishment or on any plantation or estate shall be included in the same panel.

(C. P. C. Sec. 270.) Every person shall be served at least ten days before the first day of the sessions, unless one of the judges of the Supreme Court shall have directed service. (*Vide* Sec. 273.)

(C. P. C. Sec. 275.) No juror shall be compellable to serve more than a fortnight in any one sessions, unless at the expiration of the fortnight a trial in which he is engaged as a juror is pending, and then only until the end of such trial.

(C. P. C. Sec. 278.) Application to be excused from attendance should be made in writing to the Registrar, stating the grounds on which the application is made.

Unofficial Police Magistrate.—European inquirers into death are entitled to a fee of Rs. 10 for every inquest held, and a further sum of 50 cents per mile when the distance travelled either way exceeds 5 miles.

In cases in which no inquest is actually held, but an inquiry is made, a fee of Rs. 5 will be allowed.

Batta at the rate of Rs. 7.50 will be granted for each night the inquirer is necessarily detained from home when on inquest duty. The claim in all instances shall be supported by a certificate on honour that the detention was actually necessary.

Bolters.—*Unofficial Police Magistrates cannot issue warrants for runaway coolies.* Plaintiff forms can be obtained from every police court free of charge.

Police and Headmen.—Persons within the police limits of a town and residents on estates which pay police tax are alone entitled to the services of the police. Beyond police limits the local headmen should be applied to.

Contagious and Infectious Diseases of Cattle Ordinance (25 of 1909).

THE NOTIFIABLE DISEASES ARE:—

FOR CATTLE.—*i.e.* Bulls, bullocks, cows, buffaloes, heifers, steers, calves:—Murrain or rinderpest (Sinhalese: Wasangata-roga; Tamil: Mattukotari, Mattupedi), foot-and-mouth diseases (Sinhalese: Kuralada, Katalada; Tamil: Kalnoi, Vainoi), piroplasmosis, hæmorrhagic septicæmia, pleuro-pneumonia, anthrax, tuberculosis, surra or any form of trypanosomiasis.

FOR OTHER ANIMALS.—*i.e.* Horses, mules, asses, sheep, swine, goats. Foot-and-mouth disease, anthrax, glanders, farcy, epizootic lymphangitis, osteoporosis, surra or any form of trypanosomiasis, piroplasmosis, swine fever.

Owners or others having diseased cattle or animals shall keep them segregated, and shall with all practical speed give notice to the nearest headman or police officer or stock inspector. The infected area, with its limits defined, is to be proclaimed by the Government Agent, who may close any road, etc., to the passage of cattle.

Neglect to give notice of an outbreak is a punishable offence.

Rubber Belts Prevention Ordinance (No. 21 of 1908).

RUBBER PLANTS include *Hevea B.*, *Manihot Gla.*, *Castilloa Elast.* and *Ficus Elast.* and any Rubber-producing plant which may be declared in the *Government Gazette*.

RUBBER means latex in any state other than a manufactured article

WET RUBBER means latex before completion of the drying process.

It is unlawful for any one unless duly licensed to purchase rubber.

Purchase may only be effected between sunrise and sunset, on licensed premises, from an individual personally known to the dealer, and not from any person apparently under twelve years of age or from any estate labourer.

No licensed dealer may purchase or take delivery of wet rubber from any person. It is unlawful for any one to offer for sale, or to deliver rubber between sunset and sunrise.

Births and Deaths (Ordinances 1 of 1895, 23 of 1900, 15 of 1907.)

Births.—The father or mother, or, in the case of inability of the parents by reason of death, illness or absence, the occupier or an inmate of the house where a child is born must give notice of the birth to the Registrar of the division in which the event occurred *within 48 days*.

Births on estates should be reported by the Superintendent of the estate within 48 hours of the occurrence to the Medical Officer appointed under "The Medical Wants Ordinance, 1880."

Upon reasonable doubt a Registrar may refuse to certify the legitimacy of a child in the Register, and may call for production of proofs of the parents' marriage.

A Registrar is not entitled to a fee for registration of a birth.

Deaths.—The nearest relative present at death or in attendance during the last illness of the deceased, or, any other relative living or being in the same division as the deceased, or any person present at death or of the occupier of the house, or of each inmate of the house, or the person causing the body to be buried shall give, within five days of the death, information to the Registrar.

Superintendents must report deaths similarly as shown above (Births).

Failure to report a birth or death is a punishable offence.

Persons bound to give information as above must attend at the office of the Registrar to sign the Register. If attendance is not convenient a declaration giving the necessary particulars and stamped with a 25 cts. stamp must be sent to the Registrar. The name, description and place of abode of the informant must also be given.

ORDINANCES.

The following are the names and prices of the Ordinances which may be found useful. They should be applied for to the Government Record-

keeper, at the Colonial Secretary's Office, Colombo, and should be accompanied by payment in advance.

Payment should be made by Post Office Order, Government Draft, or Cheque on a Colombo Bank. Stamps will not be accepted in payment.

| | cents. |
|---|--------|
| Branch Roads, 14 of 1896 | 10 |
| Domestic Servants, Registration of, 28 of 1871 | 5 |
| Export Duty on Tea, 4 of 1894 | 5 |
| Fertilizers Ordinance, 12 of 1901 | 5 |
| Indian Coolies employed on Estates { 11 of 1865 13 of 1889 7 of 1890 } | 15 |
| Insect Pest and Quarantine Ordinance, 5 of 1891 | 5 |
| Inventors, Exclusive Privileges to, 16 of 1892 and 6 of 1897 | 20 |
| Land Registration, 5 of 1877, 4 of 1889 and 14 of 1891 | 40 |
| Law of Evidence, 14 of 1895 | 60 |
| Mines and Machinery, 2 of 1896 | 5 |
| Oaths and Affirmations, 9 of 1895 | 5 |
| Prædial Produce, Whipping for Theft of, 4 of 1891 | 5 |
| Registration of Births and Deaths, 1 of 1895 and 23 of 1900 | 25 |
| Registration of Marriages (General), 2 of 1895 and 19 of 1900 | 25 |
| Registration of Deeds, 6 of 1866 and 15 of 1867 | 10 |
| The Road Ordinance, 1861, also 31 of 1884 and 10 of 1900 | 30 |
| Treasure Trove, 17 of 1887 | 5 |
| Trespass of Cattle, 9 of 1876 | 5 |
| Vaccination, 20 of 1886 | 5 |
| Waste, Forest, Chena, and Unoccupied Lands { 1 of 1897 1 of 1898 5 of 1900 } | 20 |
| Will and Testamentary dispositions, 21 of 1844 and 7 of 1871 | 15 |
| Branding of Cattle { 10 of 1898 1 of 1900 } | 10 |
| Cattle Thefts Prevention { 8 of 1904 32 of 1909 } | 10 |
| Cattle Disease { 9 of 1891 25 of 1909 } | 10 |
| Insect Pests, 5 of 1901 | 5 |
| Manures, 12 of 1901 | 5 |
| Medical Wants, complete | 5 |
| Rubber Thefts, 21 of 1908 | 5 |
| Cattle Trespass, 8 of 1909 | 5 |

PRÉCIS OF No. 11 OF 1865.

**An Ordinance to consolidate and amend the Law relating to
Servants, Labourers, and Journeymen Artificers under
Contracts for Hire and Service.**

1 The word "servant" shall, unless otherwise expressly qualified, extend to and include menial, domestic, and other like servants, pioneers, kanganies, and other labourers, whether employed in agricultural, road, railway, or other like work.

3 Every verbal contract for the hire of any servant, except for work usually performed by the day, or by the job, or by the journey, shall (unless otherwise expressly stipulated, and notwithstanding that the wages under such contract shall be payable at a daily rate) be deemed and taken in law to be a contract for hire and service for the period of one month, and to be renewable from month to month, and shall be deemed and taken in law to be so renewed, unless one month's previous notice or warning be given by either party to the other of his intention to determine the same at the expiry of a month from the day of giving such notice.

4 The wages of such servant shall be payable monthly, except where the service shall have been determined by notice on a day other than the last day of the month, in which case the wages for the broken period shall be payable to the day the service is so determined, and such wages, where the same shall not be payable at a monthly rate, shall be computed according to the number of days on which such servant shall have been able and willing to work; or, if payable at a monthly rate, shall be in proportion to the number of days on which he shall have been so able and willing as aforesaid. Any employer shall be entitled to discharge any such servant from his service under any such contract, without previous notice, provided such servant be instantly paid his wages, for the time he has served, and also for one month from the time of such discharge: Provided always that any such contract may at any time be determined by the misconduct of either party in their relative capacity of master and servant, which may be proved by either party against the other.

5 Every verbal contract for the hire, according to time, of any journeyman artificer (where no special contract or agreement shall have been made and duly proved) shall be deemed and taken in law to be a contract for the hire of such artificer for one day, and no longer.

6 Provided always that nothing in the preceding clauses of this Ordinance shall be construed to prevent any servant or journeyman artificer, who may continue in the service of his employer beyond the period for which any verbal contract entered into by him is respectively declared binding only in law, as aforesaid, from recovering his wages according to the full period of time of his being in such service; nor to prevent any similar subsequent verbal contract being respectively implied in law from the continuance of such service or otherwise.

7 No contract entered into in this Island for the hire and service of any servant or journeyman artificer for any period of time longer than one month shall be valid in law, so as to subject any party thereto to the provisions of this Ordinance for not performing the same, unless such contract shall be in writing, and shall clearly express the terms and conditions thereof, and shall be signed or acknowledged by the parties thereto in the presence of a Police Magistrate, or a Justice of the Peace, or other person expressly authorized by the Governor, such Justice or other person not being himself the employer of such servant or journeyman artificer or the agent of such employer. And it shall be the duty of such Police Magistrate, Justice of the Peace, or other authorized person to see that the contract is fully explained to the parties, and to certify on the contract that they fully understand the terms thereof and are desirous to fulfil the same. And such contract, when produced in evidence, and bearing the certificate of the Police Magistrate, Justice of the Peace, or duly authorized person as aforesaid, shall be *prima facie* evidence of the matters and things contained therein.

And every such contract shall be executed in triplicate; and it shall be the duty of such Police Magistrate, or Justice of the Peace, or other authorized person as aforesaid to give or to cause to be given one copy thereof to the servant, and to send or to cause to be sent, within ten days of the execution thereof, another copy thereof to the Police Magistrate of the district wherein such contract shall have been executed, and in default thereof such Magistrate or Justice shall be liable to a penalty of five pounds. And the said Police Magistrate is hereby required to preserve the said counterpart, and to allow any

person who may be interested in the said contract to inspect the same :
 Provided always that no contract (excepting contracts made under the
 8th section of this Ordinance) for the hire and service
 Exceptions. of any servant or journeyman artificer (whether made
 in Ceylon or in India, as provided by the 8th section)
 shall be valid under the provisions of this Ordinance if made for a longer
 period of hire or service than three years.

8 It shall be lawful for the Civil Engineer, the Commissioner
 of Roads, the Surveyor-General, or any other person expressly authorized
 thereunto by the Governor, to enter into any contract on behalf of
 Her Majesty for the hire and service of any person to be employed as
 a servant or artificer for any period not exceeding five years : Provided
 that such contract, if made for a period of hire or service exceeding
 one month, shall (if entered into in this Island) be in writing, and
 shall be executed in the same manner and be subject to the same
 rules as are prescribed in the preceding section as respects contracts
 in the case of persons to be employed in service other than that
 of the Government.

9 Every contract entered into in India for the hire and service in
 this Island of any servant or journeyman artificer shall
 Contracts entered into in India. be valid and binding, so as to subject the parties thereto
 to the provisions of this Ordinance, notwithstanding that
 the same be not executed in the manner prescribed
 by the 7th and 8th sections of this Ordinance : Provided that such
 contract be in writing, and signed or acknowledged by the parties thereto
 or their agents respectively, and clearly express the terms and conditions
 thereof ; and provided also that such contract be valid and binding
 according to the laws of India in force at the time of
 When valid. the entering into such contract : and every such contract
 as aforesaid when produced in any court of this Island
 shall be deemed valid and binding according to such laws as aforesaid,
 unless the contrary be proved. It shall be the duty of such employer
 or his agent with whom any such contract shall be entered into to give,
 at the time of entering into such contract, a copy thereof to the servant
 or journeyman artificer with whom such contract shall have been
 entered into.

10 Unless provision to the contrary be expressly made therein,
 no contract entered into and required to be in writing
 Contracts in writing. under the provisions of this Ordinance shall be determin-
 able before the expiration of the period specified therein,
 except by the mutual consent of the contracting parties, expressed

in writing, signed or acknowledged by them in the presence of two witnesses, or except when the party contracting to be employed shall have been convicted of an offence, or have become a prisoner, or permanently disabled from completing his contract, and his employer shall elect to determine the contract, or except for some reason sufficient in law to set it aside: Provided that, in case of such disability to serve, the employer shall be bound to furnish the immigrant from India who shall have contracted in India for any period of service in this Island, or who shall have contracted in this Island for any period of service not less than one year, with adequate means of returning to his own country.

11 Any servant or journeyman artificer who, without reasonable cause, shall neglect or refuse to attend at and during the time and hours or at the place when and where he shall have contracted to attend, in commencing or carrying on any work, or in case of no special agreement in that behalf, during such hours as, according to the trade or occupation of such servant or artificer, it shall be usual so to attend, or who, without reasonable cause shall leave unfinished or refuse to finish any work contracted to be done, or who shall be guilty of any drunkenness, wilful disobedience of orders, insolence, or gross neglect of duty, or other misconduct in the service of his employer or who shall quit the service of such employer without leave or reasonable cause, before the end of his term of service or previous warning as required by the third clause of this Ordinance, or for such longer period as may be specially stipulated in his contract, shall be punishable by the Police Court of the district wherein such offence shall have been committed, or wherein the offender shall have been apprehended, with imprisonment of either description for a term which may extend to three months, or with a fine not exceeding fifty rupees, or with both; and further, such court may, at its discretion, order all wages then due to such offender to be forfeited if not exceeding the wages of one month or for the period of warning stipulated for.

12 Every servant who, having engaged to go on any journey, shall, without any just cause, desert, or refuse, or neglect to proceed on such journey or any stage thereof, or shall be guilty of any misbehaviour mentioned in the 11th clause of this Ordinance, shall be punishable by the Police Court of the district wherein such offence shall have been committed, or wherein the offender shall have been apprehended, by forfeiture of all wages then advanced or

contracted for, or by imprisonment with or without hard labour not exceeding three months, or by such forfeiture together with such imprisonment, at the discretion of the said court; Provided always that no servant engaged for a journey shall be obliged to travel on foot more than twenty-five miles during every

twenty-four hours; nor shall any coolie engaged for a journey be obliged to carry a greater weight than forty pounds, unless otherwise expressly agreed upon for a short distance only, nor to proceed in case of any actual illness or bodily injury rendering him incapable to travel the journey, or any stage thereof, and any person obliging any servant or coolie so engaged as aforesaid to act contrary to the regulations contained in this proviso shall be punishable by such Police Court as aforesaid by a fine not exceeding five pounds or by imprisonment, with or without hard labour, not exceeding three months, or by such fine together with such imprisonment, at the discretion of the said court.

13 Upon any complaint by any servant or journeyman artificer for non-payment of wages, or damages for breach of contract or misconduct by his employer, before a court having jurisdiction in that behalf, it shall be lawful for such court, at its discretion, to make a proportional abatement out of any sum to be awarded as the wages or damages due to any such servant or artificer, for such days or time as he shall have been proved to have been, without the consent of his employer, absent from or neglecting his service or work, and also for the value of any breakages or damage done to any of the property of his employer by or through the misconduct or gross negligence or carelessness of such servant or journeyman artificer.

14 In case any employer, not having reasonable cause of complaint, shall refuse payment of wages when due, or not having given such notice or made such payment as required by the 3rd and 4th sections of this Ordinance shall refuse to continue full payment to any servant or journeyman artificer during the whole term of any contract entered into between them, every such employer so refusing shall, in addition to payment of all wages actually due, or of all that would have become due if the contract had been properly observed, or both, as the case may be, be liable to a fine not exceeding five pounds, or to imprisonment not

exceeding three months, or to such fine together with such imprisonment, at the discretion of the court.

15 If any person shall knowingly and wilfully pretend or falsely assert in writing that any servant or journeyman artificer has been hired or retained in his service or employment, or in the service or employment of any other person or persons, for any period of time whatsoever, other than that for which such servant or artificer shall have been so employed, hired, or retained, or if any person shall otherwise knowingly and wilfully write, sign, or give any untrue, false, forged, or counterfeit certificate or writing in favour of the character of such servant or artificer, then in every such case such person or persons so offending shall be liable to a fine not exceeding ten pounds, or to imprisonment, with or without hard labour, not exceeding twelve months, or to such fine together with such imprisonment, at the discretion of the court.

Employers or others giving false certificates.

How punishable.

16 If any person shall offer himself as a servant or journeyman artificer, asserting or pretending that he hath served in any service or employment in which such servant shall not actually have served, or with a false, forged, or counterfeit certificate of his character, or shall in anywise add to or alter, efface, or erase any word, date, matter, or thing contained or referred to in any certificate given to him by his last or any former actual employer, or by any other person or persons duly authorized by such employer to give the same, then in any of the said cases such person or persons so offending shall be liable on conviction to a fine not exceeding three pounds, or to imprisonment, with or without hard labour, not exceeding three months, or to such fine together with such imprisonment, at the discretion of the court.

Servants using false certificates.

How punishable.

17 If any person, having been before in service or employment as a servant or artificer, shall, when offering to hire himself in any employment, capacity, or service, falsely and wilfully pretend not to have been hired or retained in any such previous employment, capacity, or service, then and in such case every such person so offending shall be liable on conviction to a fine not exceeding three pounds, or to imprisonment, with or without hard labour, not exceeding three months, or to such fine together with such imprisonment, at the discretion of the court.

Servants denying a previous employer.

How punishable.

18 *Repealed.*

19 Any person who shall wilfully and knowingly seduce or attempt to seduce from his service or employment any servant or journeyman artificer, bound by any contract to serve any other person or persons, or who shall wilfully and knowingly take any servant or journeyman artificer while so bound into his service or employment, or who shall wilfully and knowingly harbour or conceal any servant or journeyman artificer who shall have absented himself without leave from the service of such other person to whom he is so bound, or who shall wilfully and knowingly retain in his service any servant or journeyman artificer bound under any contract to serve any other person after receiving notice in writing that such servant or journeyman artificer is so bound as aforesaid, shall be guilty of an offence, and be liable on conviction thereof to a fine not exceeding five pounds in respect of each of the servants or journeymen artificers whom he shall have so seduced, taken, or harboured, or concealed, or retained as aforesaid, and to imprisonment, with or without hard labour, for any period not exceeding three months, if the court shall see fit to impose such imprisonment. Every such offence shall be cognizable before any Police Court having jurisdiction in the district wherein the offence was committed or the offender apprehended.

Seducing or harbouring a servant or journeyman artificer.

How punishable.

20 Any person who shall take into his service or employment or harbour, conceal, or retain any servant or journeyman artificer bound to serve another by any contract entered into under any of the provisions of the said Ordinance, without taking reasonable precautions to ascertain whether or not such servant or artificer is so bound, or knowing him to be so bound, or after notice that he is so bound, shall, if the servant or artificer be at the time so taken, harboured, or concealed, or retained, under advances from the person to whom he was so bound, be liable civilly to pay to such person as liquidated damages double the amount of such advances.

Employing or harbouring a servant or journeyman artificer without reasonable precautions in discovering whether he is bound to another employer.

21 No servant or journeyman artificer shall be liable to punishment, for neglecting or refusing to work, or for desertion, disobedience, or neglect of duty, if at the time of such alleged offence his wages shall have been unpaid for any period longer than a month: Provided always that in computing the amount of wages due at any time such servant or journeyman artificer shall be debited with the amount of all advances of money made to him, and with the value of

Servant or journeyman artificer not bound to work when wages are overdue.

all food, clothes, or other materials supplied to him, and which the employer is not liable under this Ordinance to supply at his own expense: Provided also that the fact of such wages being so due as aforesaid shall not affect the liability of such servant or journeyman artificer to punishment under the provisions of this Ordinance, unless he shall at least forty-eight hours previously to the time of such alleged offence have demanded from his employer the payment of his wages so due, and the employer shall have refused or failed to pay the same.

22 Every kangany or other agent who, having been entrusted with any money or valuable security by any person or persons for the purpose of engaging or procuring for hire and service any servant or servants, artificer or artificers, for such person or persons, shall, with intent to defraud, convert, or appropriate the same or any part thereof to or for his own use or benefit, or the use or benefit of any person or persons other than such person or persons as aforesaid or for any purpose other than such purpose as aforesaid, shall be guilty of an offence, and, being convicted thereof, shall be liable, at the discretion of the court, to be transported for any term not exceeding seven years, or to be imprisoned for any term not exceeding three years, with or without hard labour.

23 Whenever any servant or journeyman artificer is brought before any court or Justice of the Peace, on the ground of his having quitted the service of his employer, or having refused or neglected to work, without leave or reasonable cause before the end of his term of service or previous warning, such court or Justice of the Peace may, if the employer of such servant or his agent so requires, and the labourer consents thereto, instead of punishing or committing the offender, direct him to return to the service of his employer; and the court or Justice shall keep a record of the proceedings had before him, and shall certify at the foot thereof that he has satisfied himself that the servant has of his own free will consented to return to the service of his employer.

24 If any servant or journeyman artificer, having entered into any contract of hire and service subject to the provisions of this Ordinance, shall, during the subsistence of such contract, have been imprisoned or have absented himself without leave, the court before which he is tried shall award that no part of the period of such imprisonment or of such absence (and which period the said court is to ascertain by evidence and define) shall be deemed or taken to be a part of the period of his service, but that he shall be com-

Misappropriation of recruiting funds by a kangany or agent.

Bolter or malingering can by consent be directed by the court to return to the estate in lieu of punishment.

Absence without leave or imprisonment not to count as a portion of an agreement period.

pellable, at the option of his employer, to serve for the full period defined as aforesaid for which he shall have contracted to serve; and until such extended service shall have been completed he shall be and shall continue subject to the provisions of this Ordinance.

25 If the estate upon which any agricultural servant or journeyman artificer is employed under any contract to serve for a period exceeding one month shall, during the pendency of such contract, become vested in or be transferred to or placed under the superintendence or management of any person other than the person with or by whom such contract was entered into, such contract and all the rights and liabilities incidental thereto shall be deemed in law to be transferred to the person in or to whom the said estate shall become vested or transferred as aforesaid, or under whose superintendence or management the said estate shall be placed as aforesaid, and such last-mentioned person and such servant or artificer shall be respectively bound to perform all the terms and conditions of the contract in the same manner, or as near thereto as the nature of the case will admit, as if the contract had been originally entered into between such person and such servant or artificer: Provided always that in case such estate shall become vested in or transferred to any person other than the person with whom such contract shall have been entered into, such servant or journeyman artificer shall thereupon be entitled to determine such contract, if he shall so elect, and give notice of such being his intention to the person in whom the estate shall have become vested or to whom it shall have been transferred, and shall receive all wages then due to him under or by virtue of such contract: Provided, however, that the last-mentioned proviso shall not be held to apply to cases where estates are held in partnership by several persons, and where one or more of the partners retire from the partnership, or when, on such retirement, other partner or partners shall take the place of the retiring partner or partners, one or more of the original partners who were parties to the contract continuing in the partnership.

26 Neither the alleged commission of any crime or offence by any person or persons under the provisions of this Ordinance, nor the conviction nor acquittal of any person or persons of any crime or offence under this Ordinance, shall be a bar to any civil action for damages against such person or persons at the instance of any person or persons who may have suffered any injury, or who may

Change of ownership or superintendence of estate, *ipso facto*, transfers labour to new owner or superintendent.

Labourer can determine contract by due notice.

Partnership not affected by the above.

Alleged commission of crime or conviction no bar to civil action.

allege that he or they has or have suffered any injury from or by reason of the commission of any such crime or offence.

27 Any servant who shall be incapacitated by sickness from labour whilst in the service of any employer shall be entitled to lodging, food, as well as medical care, at the expense of such employer during such incapacity; provided that the employer shall not be bound to pay to the servant during such period his wages in addition: Provided further, that nothing herein contained shall prevent the employer from determining the contract under the 10th section of this Ordinance in case the servant shall become permanently disabled from completing his contract.

Labourer incapacitated by sickness must be fed, housed, and medically attended. No wages payable.

Option of determining contract under sec. 10. (q. v.)

An Ordinance relating to Indian Coolies employed on Ceylon Estates.

No. 13.—1889.

(Amended by No. 9 of 1909.)

3 For the purposes of this Ordinance—

“Estate” means any land in which labourers are employed, and of which ten acres or more are actually cultivated.

“Labourer” means any labourer and kangani (commonly known as “Indian coolies”) whose name is borne on an estate register, and includes the Mohammedans, commonly known as “Tulicans.”

“Wages” means all sums which may be due to a labourer for and in respect of the work and labour done by him on an estate.

“Employer” means the chief person for the time being in charge of an estate, and includes the superintendent.

“Check-roll” means the record kept on an estate showing the work done by labourers employed under a monthly contract of service with the estate, the wages earned by them, the advances made, and the monthly balance of wages due to them.

“Register” means the book required to be kept by section 22.

4 Except as in this Ordinance otherwise expressly provided, all the provisions, regulations, pains, penalties, forfeitures, and abatements enacted in the principal Ordinance, so far as they are applicable to monthly servants or their employer, shall extend, and be construed, deemed, and adjudged to

All regulations of principal Ordinance to apply.

extend, to labourers and employers under this Ordinance ; and every act or default, by whomsoever done or committed, which is made punishable by the principal Ordinance, if made or committed in respect of, or in relation to, monthly servants or their employers, shall in the like manner be punishable if done or committed in respect of, or in relation to, labourers and employers under this Ordinance.

4A No criminal proceedings shall be instituted against any labourer for any offence under section 11 of Ordinance No. 11 of 1865, as amended by "The servants' and labourers' Ordinance, 1905," after thirty-six months shall have elapsed from the date when such offence is alleged to have been committed.

5 Every labourer who shall enter into a verbal contract with the employer for the performance of work not usually done by the day or by the job or by the journey, or whose name shall be entered in the check-roll of an estate and who shall have received an advance of rice or money from the employer, shall, unless he has otherwise expressly stipulated, and notwithstanding that his wages shall be payable at a daily rate, be deemed and taken in law to have entered into a contract of hire and service for the period of one month, to be renewable from month to month ; and every such contract shall be deemed and taken in law to be so renewed unless one month's previous notice be given by either party to the other of his intention to determine the same at the expiry of one month from the day of giving such notice.

6 (1) It shall be the duty of every employer to pay the wages of the labourers in his employment monthly within one month from the expiration of the month during which the wages have been earned.

(2) Where wages are payable at a daily rate, the monthly wages shall be computed according to the number of days on which the labourer was able and willing to work and actually demanded employment, whether the employer was or was not able to provide him with work. Provided that an employer shall not be bound to provide for any labourer more than six days' work in the week.

(3) When the contract of service is determined by one month's previous notice or warning by the labourer to the employer or by the employer to the labourer, all wages due to the labourer for his period of service shall be paid in full to him by the employer on the day when such contract is so determined as aforesaid.

(4) In computing the amount of wages due to a labourer for any period of service, the labourer shall be debited with the amount of all advances of money made to him by his employer and with the value of all food, clothes, or other articles supplied to him, which the employer is not liable in law to supply at his own expense.

(5) The wages of a labourer shall not be deemed to have been duly paid as required by this section, unless--

(a) The full amount thereof, subject only to the deductions allowed by sub-section (4), has been paid directly to the labourer himself; or

(b) At least one-half of such full amount, after such deductions as aforesaid, has been paid directly to the labourer himself, and the balance has been paid to some person expressly authorized by the labourer to receive the same on his behalf or on his account, and the receipt of such person for such payment has been delivered to the labourer.

(6) Where, owing to the absence of any labourer or to any other unavoidable cause, it has not been possible to pay him his wages within the time limited by this section, the employer may retain the sum due to such labourer and shall thereafter pay it to him at the earliest possible opportunity.

(7) Any employer who fails to pay the wages of any labourers in his employment within the period limited by sub-section (1) shall be guilty of an offence, and shall be liable on conviction to a fine which may extend to fifty rupees on a first conviction, and to two hundred rupees on a second or subsequent conviction. If any fine imposed under this section is not paid within twenty-one days of the date when the same is imposed, the Government Agent may recover the amount thereof in the manner provided by section 23 of "The Medical Wants Ordinance, 1880."

7 No labourer shall be liable to punishment for neglecting or refusing to work, or for quitting service without leave or reasonable cause, or for disobedience, or for neglect of duty, if at the time of such alleged offence any monthly wages payable to him as provided in section 6 shall not have been paid in full, and he shall, at least forty-eight hours previously, have demanded from his employer the payment of such wages, and the employer

Deduction
from wages of
advances, etc.

Wages payable
directly to
labourer or
one half of
nett wages to
labourer and
balance to
labourer's au-
thorised agent.

Absent labour-
er's wages may
be retained by
employer pay-
able at earliest
opportunity.

Employer
failing to pay
wages in due
time is guilty
of an offence.

Labourer not
liable to
punishment
for refusing to
work or for
quitting ser-
vice, monthly
wages not paid
in full.

shall have refused or failed to pay the same. Provided, however, that no previous demand as aforesaid shall be necessary on the part of the labour in case such wages, exclusive of "head money" (*tulé kasi*) in the case of kanganyes, shall amount to ten rupees or more.

8 No contract of service entered into with a labourer for any period of time longer than one month shall be valid in law unless the same is executed in all respects in strict accordance with the requirements of the principal Ordinance as to written contracts; and all written contracts between labourers; and employers shall be subject to, and governed by, the provisions of the principal Ordinance relating to written contracts.

9 Labourers employed on an estate shall, anything in the Ordinance No. 22 of 1871 to the contrary notwithstanding, have in respect of their wages, whatever the period for which such wages may be due, but not exceeding the sum of twenty rupees earned by each labourer, a first charge upon such estate, and such first charge shall have priority over all claims for rents, dues, or otherwise by any lessors, mortgagees, judgment, execution or other creditors, or by any other persons whatever; and such first charge may be enforced by suit or by claim if instituted or preferred within three months of the last day of the period in respect of which such wages are claimed.

10 The wages due to any labourer or labourers, whatever may be the amount claimed, shall be sued for in a court of requests having in other respects jurisdiction in that behalf; and it shall be lawful for one or more labourers employed on such estate to institute one suit to recover the wages which may be due, not only to him or them, but also to any other labourer or labourers employed on the same estate whose name or names may appear in the plaint, provided that the court in which the suit is instituted is satisfied, after due inquiry, that the labourer or labourers suing is or are authorised to sue for and on behalf of the other or others so named as aforesaid.

11 In any suit instituted under this Ordinance it shall be sufficient to designate the defendants as the "proprietor of the ——— estate," specifying the name of the estate on which the labourer had been employed, without naming the proprietor or proprietors thereof.

12 The party sued or his representative, or any other person allowed by the court to intervene in such suit, shall be entitled to a set-off or counter-claim in respect of any sum of money, or the fair and reasonable price of any food, clothes, or other articles which the employer was not liable in law to supply at his own expense, but which money, food, clothes, or other articles had been advanced or supplied to the labourer or labourers as against the wages for which he or they may be suing.

13 It shall be lawful for a mortgagee of an estate to pay and discharge the first charge created by this Ordinance in respect of such estate in favour of the labourers employed thereon; and upon such payment he shall be entitled to add the amount thereof to the sum due upon his mortgage; and the amount so added shall be secured by the mortgage held by him.

14 When the proprietor of an estate is sued under this Ordinance, and he shall by proof adduced satisfy the court that he did not by himself or by his agent or agents employ all or any of the labourers who are suing him, but that they or any of them were employed on such estate by some other person as trustee, lessee, or mortgagee in possession, he shall be entitled, upon application by him made for that purpose, to have such other person made a party defendant in the same suit at any time before execution is levied, provided that such other person shall have had reasonable notice of such application, and shall have failed to show cause why he should not be joined in the suit. And the court shall, if satisfied that such other person was primarily liable to pay the amount of wages sued for wholly or in part, and that the same has since the institution of the suit been paid and satisfied by such proprietor, enter a separate judgment therefor as between the proprietor, and such other person, with such reasonable costs as it may think fit, and enforce such judgment against such other person by a writ of execution.

Provided, however, that no proceedings had as between such other person and such proprietor as aforesaid shall be permitted in any way to delay the progress of the suit as between the labourers and such proprietor.

15 The Rules and Orders in Schedule "A" hereto shall apply to suits instituted under this Ordinance; and upon any matter not specially provided therein, including the payment of costs, the General Rules and Orders for Courts of Requests shall be followed in so far as the same may be applicable.

16 Every employer shall, on the tenth day of January, on the tenth day of April, on the tenth day of July, and on the tenth day of October of each year make to the Government Agent of the Province in which the estate is situate, or to some other public officer who may be appointed by the Governor for that purpose, and of whose appointment a notice shall be published in the *Government Gazette*, true and correct returns, for and in respect of the three months next immediately preceding each of the said four months, containing each and every of the particulars set forth in the form given in Schedule B hereto. The returns shall be made in the English language, and copies of the said form shall be furnished by such Government Agent on the application of the employer free of charge.

Provided that if any of the aforesaid days shall be a Sunday or public holiday, the said returns and declaration shall be made on the next following day not being a public holiday.

17 Any employer who shall refuse or neglect to make any returns by this Ordinance required to be made, in the form and on the days herein specified, shall be guilty of an offence, and shall be liable on conviction to a fine not exceeding one hundred rupees; and the production of a certificate under the hand of the Government Agent, to the effect that no returns have been received by him from the person charged, shall in all judicial proceedings be *prima facie* evidence of such person having refused or neglected to make such returns, as the case may be.

18 The Government Agent or such other officer as aforesaid shall forward all such returns to the Colonial Secretary, who shall, as soon as convenient, publish, or cause to be published, in the *Government Gazette*, a general abstract of the returns received for any one quarter, in such form as the Governor, with the advice of the Executive Council, shall from time to time require. And an annual general abstract of all such returns for each year shall be laid before the Legislative Council.

19 From and after the commencement of this Ordinance no kangani, subordinate kangani, or labourer shall be liable to arrest under the provisions of "The Civil Procedure Code, 1889," in execution of a decree for money.

20 A notice or warning of the intention of any labourer to determine his contract of service, if given by any other person on behalf of the labourer, shall not begin to run or be in any way effectual in law, unless and until the labourer has personally signified to his employer his desire to determine his contract of service.

21 (1) It shall be the duty of every employer to forward to the Government Agent of the Province in every month a declaration under his hand that the wages of the labourers in his employment have been duly paid as required by this Ordinance.

Monthly declarations of payment of wages to be made.

(2) Every such declaration shall be forwarded so as to reach the kacheheri within thirty-four days of the last day of the month for which the wages were earned, and shall be in form I. in schedule C hereto.

(3) Where an employer has given notice in writing to the Government Agent with regard to any estate under his charge that the duty of forwarding the declaration required by this section has been entrusted to an assistant superintendent, such assistant superintendent shall thereupon be bound to comply with the requirements of this section.

(4) Any employer, or any assistant superintendent who is bound as aforesaid to comply with the requirements of this section, who fails in any month to furnish the declaration required by this section within the prescribed time, shall be guilty of an offence, and shall be liable, on a first conviction, to a fine which may extend to twenty rupees, and, on a second or subsequent conviction, to a fine which may extend to one hundred rupees.

Liability for failure to make a declaration.

(5) Any employer or assistant superintendent bound as aforesaid who knowingly furnishes a declaration which is false or incorrect in any material particular shall be guilty of an offence, and shall be liable on conviction to imprisonment of either description which may extend to three months, or to a fine not exceeding five hundred rupees, or to both.

False declaration, how punishable.

22 (1) It shall be the duty of every employer to prepare and keep up to date a complete register of all labourers employed on his estate, whether borne on the check-roll or working on any form of contract. Such register shall be as nearly as material in form II. in schedule C hereto.

Complete register of all labourers to be kept on estate.

(2) Every employer shall forthwith enter on the register the names of any labourer who shall be taken into employment on his estate, whether on monthly contract of service or any other form of contract. He shall also, whenever a labourer dies or quits service, record the fact and the date thereof in the register.

What is to be recorded, liability for neglect.

Any employer who fails to comply with the requirements of this sub-section shall be guilty of an offence, and shall be liable on conviction to a fine not exceeding twenty rupees.

- 23** (1) From and after the commencement of this Ordinance no employer shall take into his employment, or allow to be employed on any contract on his estate, any labourer other than a boy or girl who has been born in Ceylon and has not previously been employed on an estate, unless he has received in respect of such labourer—

No recruited labour to be employed unless a discharge ticket is produced or a Ragama ticket, or Magistrate's certificate, liability for neglect.

- (a) A discharge ticket issued and forwarded to him by some other employer in accordance with section 24; or
 (b) In the case of a newly imported labourer, a certificate issued from the cooly depot at Ragama in accordance with section 25; or
 (c) A certificate issued by a Police Magistrate in accordance with section 26.

(2) Any employer who shall take into his employment or shall allow to be employed on any contract on his estate any labourer in contravention of this section shall be guilty of an offence, and shall be liable on conviction thereof to a fine which may extend to five hundred rupees, or to imprisonment of either description for a term not exceeding six months, or to both.

- 24** (1) Whenever any labourer quits the service of any employer, having given the notice or warning required by law, or

Duty of employer to prepare a discharge ticket.

having been authorized to do so by his employer by means of the document known as a *tundu*, it shall be the duty of the employer to prepare a discharge ticket as nearly as material in the form III. in schedule C. If the labourer entered the service of the employer on a discharge ticket, the employer shall file such discharge ticket in his office and shall prepare a new discharge ticket.

- (2) Where the labourer quits the service of his employer in order to take service with some other employer in Ceylon, the former employer shall forthwith forward the discharge ticket to the new employer. But in no case shall the discharge ticket be given to the labourer.

To be given to new employer.

- (3) Where a labourer has given the notice or warning required by law, but has not, at the time when he quits the service of his employer, secured any other employment, it shall be the duty of the employer to give him a memorandum in the form IV. in schedule C. stating that the labourer has duly given notice and that a formal discharge ticket will be issued to any new employer on application; and also stating the amount of the labourer's unliquidated liability, if any. Upon such application being made it shall be the duty of the employer to forward to the new employer within five days of the date of application a dis-

Exception in case of unemployed cooly and details to be given.

charge ticket, on which shall be stated the amount of the labourer's unliquidated liability, if any, to the estate or to any kangani employed thereon.

(4) Where any employer, having taken into his employment any labourer upon a discharge ticket showing that such labourer was indebted to any previous employer, issues a discharge ticket for such labourer to another employer, he shall state on such last named discharge ticket the amount of the labourer's unliquidated liabilities, if any.

(5) Where a kangani and the labourers in this gang give notice of their intention to quit the service of any employer, it shall be the duty of the employer, if the kangani is indebted to the estate in respect of moneys advanced to him on account of the labourers in his gang, to state on any memorandum or discharge ticket issued in respect of any such labourer the name of the kangani to whose gang the labourer belongs, and the amount to which the kangani is indebted to the estate as aforesaid.

(6) Any employer who fails to prepare or to forward a discharge ticket, or to give to any labourer a memorandum in any case where he is required by this section to do so, shall be guilty of an offence, and shall be liable on conviction thereof to a fine which may extend to one hundred rupees, and a further fine not exceeding five rupees for every day during which such default shall continue.

25 (1) The Superintendent of the cooly depôt at Ragama, or such other officer as may be authorized by the Governor for the purpose, shall prepare certificates in the form V. in schedule C with regard to all labourers and their children despatched from the depôt and shall forward the same to the employers to whom the labourers are despatched.

(2) Whenever the Superintendent of the cooly depôt at Ragama or such other officer as aforesaid has despatched any labourer to any estate and has forwarded with respect to such labourer the certificate mentioned in the preceding subsection, such labourer shall be deemed to have entered into a contract of hire and service with the superintendent of such estate for the period of one month, renewable and determinable in manner provided by section 5 of this Ordinance.

(3) In the event of any other depôt being established for the reception of Indian immigrant labourers, the Governor may authorize the officer in charge of such depôt to issue certificates for the purpose of this Ordinance; and such certificates shall, for the purpose of this Ordinance, be equivalent to certificates issued from the depôt at Ragama.

26 (1) On the application of any labourer any Police Magistrate, if he is satisfied by affidavit that such labourer has not been employed on an estate in Ceylon for the thirty-six months immediately preceding the date of application, or that he has quitted the service of his employer on reasonable cause, shall issue to the intending employer of such labourer a certificate to such effect in the form VI. in schedule C.

Cooly unemployed for 36 months can obtain Police Magistrate's certificate.

No stamp duty payable. (2) No stamp duty shall be chargeable on affidavits sworn or affirmed for the purposes of this section.

27 (1) Any Police Magistrate, if he is satisfied that any discharge ticket has been lost or destroyed, may, on the application of the labourer to whom the discharge ticket refers or of his employer, order or authorize the employer by whom such discharge ticket was given, or, if such employer is no longer in charge of the estate on which the labourer was employed, then the person for the time being in charge of such estate, on payment to him by the applicant of a fee of fifty cents for each discharge ticket, to prepare and forward to the new employer a duplicate of the lost or destroyed discharge ticket.

Lost or destroyed discharge ticket, method of obtaining duplicate, and fee for same.

(2) Any person failing to prepare and forward a duplicate discharge ticket on the order of a Police Magistrate when the prescribed fee has been tendered to him, or issuing a duplicate discharge ticket without the authority of such order, shall be guilty of an offence, and shall be liable on conviction thereof to a fine not exceeding one hundred rupees.

Failure to prepare duplicate renders liable to fine.

28 Any person who—

1. False discharge tickets. (a) Knowingly prepares or issues a discharge ticket which is false in any material particular; or
2. Fraudulent use of discharge ticket. (b) Fraudulently makes use of a genuine discharge ticket; or
3. False entry in register. (c) Knowingly makes any false entry alteration in or addition to the register required to be kept by this Ordinance; or
4. Unauthorised issue of a discharge ticket. (d) Not being an employer as defined in section 3 of this Ordinance issues a discharge ticket in respect of any labourer—

How punishable.

shall be guilty of an offence, and shall be liable on conviction thereof to a fine which may extend to one thousand rupees, or to imprisonment of either description for a term not exceeding six months, or to both.

- 29** The Governor in Executive Council may from time to time make such alterations as he may deem requisite in any of the forms prescribed in schedule C hereto, or may prescribe new forms to be used in substitution for any of such forms.
- 30** No criminal proceedings shall be instituted in respect of any alleged offence under sections 21, 22, 24 and 28 without the previous sanction in writing of the Colonial Secretary.

No criminal proceedings in respect of sections 21, 22, 24 & 28 without sanction of Col. Sec.

SCHEDULE A.

Rules and Orders.

- 1** The suit shall commence by the filing of a plaint setting out the period or proximate period for which wages are due to the plaintiff, or to each of the plaintiffs if there be more than one plaintiff; and thereupon the chief clerk shall issue a summons directed to the defendant requiring him to appear before the court on a day therein named to answer the claim of the plaintiff or plaintiffs, and shall at the same time issue a subpoena to the superintendent of the estate requiring him on the same day as that named in the summons to attend and bring with him the check-rolls and any other documents which may be specified in such subpoena, and shall at the same time cause a notice in form hereunto annexed to be published in the *Government Gazette* of the two following weeks.
- 2** The summons directed to the defendant shall be served upon the superintendent, or, if the commissioner so directs, shall be affixed to a conspicuous part of the estate, and such service shall be deemed to be good and sufficient service on the defendant; and in every case the chief clerk shall post a copy of such summons to the superintendent directed to such estate. It shall be competent for such superintendent to appear for and represent the defendant in the said suit, and to adduce evidence therein.
- 3** On the day named in such summons, or on any other day to which the commissioner may adjourn or postpone the inquiry, he shall summarily hear and determine the suit and give judgment thereon for such sum or sums as the plaintiff or plaintiffs may be found entitled to; and in determining the sum due to the plaintiff, or if there be more than one plaintiff, the sum due to each of the plaintiffs, the commissioner shall apply any pay-

Filing of plaint issue of summons, and subpoena.

Service of summons on estate.

Commissioner to summarily determine the suit.

ments, whether in money or in food, clothes, or other articles proved to have been made in partial discharge of wages, towards the payment of the antecedent wages in the order of time in which the same became due, and the commissioner shall in his judgment specify the extent to which the first charge shall apply, and shall declare the estate bound and executable for and in respect of such first charge.

Provided, however, that if the commissioner be satisfied that the sale of any definite portion of the said estate shall be sufficient to satisfy the first charge he may, in the first instance, order accordingly.

4 As soon as may be after the judgment is pronounced a formal decree bearing the same date as the judgment shall be drawn by the commissioner in the form hereto annexed specifying (1) the total amount due to the plaintiffs and (2) the amount for which the estate is bound and executable for and in respect of the first charge.

5 The commissioner on non-payment of the amount of the first charge shall issue a writ in the form I. hereunto annexed and on non-payment of the balance (if any) due under the decree shall issue a writ in the form II. hereunto annexed, which writs may issue simultaneously or independently of each other.

6 The judgment in the suit shall not be declared, satisfied or discharged save by payment into court of the total amount decreed, or by deposit in court of such amount by levy in execution; and when such judgment shall be satisfied by payment into court, or when payment shall be made of the first charge, the commissioner shall issue a certificate to that effect under his hand to the person making such payment.

7 The fiscal shall execute a conveyance of the said estate or part thereof on sale in execution in favour of the purchaser in the form hereto annexed, and the same shall be sufficient to vest title in the purchaser free from all encumbrances.

8 Upon the payment into or deposit in court of the amount decreed or levied, the commissioner shall pay or distribute the same to or among the plaintiff or plaintiffs adjudged to be entitled thereto, and make a record thereof.

9 It shall be competent for any mortgagee or other person interested in the suit to intervene therein, if allowed by the court to do so.

Notice.

NOTICE is hereby given that a suit has been instituted in the Court
 of Requests of—, by—(insert number) labourers
 Form of of—estate, against the proprietor or proprietors
 notice. thereof, under the Ordinance No.—of 1889, for the
 recovery of their wages amounting to Rs.—.

This—, day of—, 18

Chief Clerk.

Form of Decree.

It is ordered and decreed that the proprietor of the—estate
 do forthwith pay into court for the use of the plaintiffs
 Form of decree the sum of Rs.—, and that the said—estate for
 if a portion only of the estate is declared, bound and executable, here
 describe definitely the said portion of the estate], bounded or reputed to
 be bounded on the north by—, east by—, south by—, and
 west by—, containing in extent—acres, is bound and executable
 to the plaintiffs for a first charge to the extent of Rs.—.

It is further ordered and decreed that the proprietor of the said
 estate to pay to the plaintiff the costs of this action.

Form of Writ 1.

In the Court of Requests of—

—, Plaintiff.

Vs.

Proprietor of—estate, Defendant.

To the Fiscal of the—Province.

WHEREAS by a judgment pronounced by the Commissioner of the
 Court of Requests of—in case No.—, it was
 Form of writ. ordered and decreed that the proprietor of the—estate
 do pay into court, in the said suit, the sum of Rs.—,
 and the said—estate (hereinafter described) was thereby declared
 bound and executable for a first charge to the amount of Rs.—;
 and whereas the proprietor of the said—estate had made default in
 paying the said amount:

Levy and make of the said estate, bounded or reputed to be bounded
 on the north by—, east by—, south by—, and west by—
 —, containing in extent—acres, declared by the judgment of

this court bearing date the——day of——, bound and executable for a first charge to the extent of Rs.——, by seizure, and, if necessary, by sale thereof [or part thereof to be defined] the sum of Rs.——, and have that money before this court on the——day of ——to render to the said——, and inform this court for what sum or sums, and to what person or persons, you have sold the said estate [or part thereof], and have you there this mandate.

By order of court,

Chief Clerk.

Form of Writ II.

In the Court of Requests of——.

——, Plaintiff.

Vs.

Proprietor of——estate, Defendant.

To the Fiscal of the—— Province.

WHEREAS by a judgment pronounced by the Commissioner of the Court of Requests of——in case No.——, it was
 Form of writ (II.) ordered and decreed that the proprietor of the—— estate do pay into court the sum of Rs.——, of which sum the sum of Rs.——was declared a first charge on the—— estate, and the balance sum of Rs.——has not been paid into court:

Levy and make of the houses, lands, goods, and credits of the proprietor of the said——estate by seizure, and, if necessary, by sale thereof, the sum of Rs.——, and have the money before this court on the——day of —— to render to the said——, and inform this court for what sum or sums, and to what person or persons, you have sold the said property respectively, and have you there this mandate.

By order of court,

Chief Clerk.

Form of Conveyance by Fiscal.

WHEREAS by a judgment pronounced by the Commissioner of the Court of Requests of——in case No.——, it was
 Form of conveyance by Fiscal. ordered and decreed that the proprietor of the—— estate do pay into court, in the said suit, the sum of Rs.——, and the said estate (hereinafter described) was thereby declared bound and executable for a first charge to the amount of Rs.——: And whereas the proprietor of the—— estate hath made default in paying the said amount, and by writ of

execution issued from the said court bearing date——, directed to the Fiscal for the——Province, he was directed to levy the said amount by the sale of the said estate [or part thereof, as the case may be]: And whereas the said estate [or part thereof] was seized in execution under the said writ, and after due notice was exposed to public sale on the——day of——, at——, by——, acting under the authority of the said Fiscal, and sold to——as the highest bidder for the sum of Rs.——, and the said——has paid the said sum to the said Fiscal: Now these presents witness that——, the said Fiscal for the——Province, in consideration of the said sum of Rs.——paid by the said——, the receipt whereof the said Fiscal doth hereby acknowledge, hath sold and assigned, and doth by these presents sell and assign unto the said——, his heirs, executors, administrators, and assigns the——estate, bounded or reputed to be bounded on the north by——, east by——, south by——, and on the west by——, containing in extent——acres, and described in the map or diagram annexed, to have and to hold the said estate with its and every of its appurtenance by him the said——, his heirs, executors, administrators, and assigns for ever free from all incumbrances.

In witness whereof the said Fiscal hath hereunto inscribed his name at——this——day of——, the year of our Lord One thousand nine hundred and

Witnesses.

Signature of Fiscal.

SCHEDULE B.

I.—Return of Labourers employed on the——Estate, in the District of——, during the Quarter ended——, 19—.

| | Male. | Female. |
|---------------------|-------|---------|
| Number of Labourers | | |

II.—Return of Births occurring among labourers upon the above Estate during the Quarter.

| Date of Birth. | Mother's Name. | Father's Name. |
|----------------|----------------|----------------|
| | | |

III.—Return of Deaths occurring among Labourers upon the above
Estate during the Quarter.

| Name. | Age. | Sex. | Name of Village. | Date of Death. | Probable cause of Death. |
|-------|------|------|------------------|----------------|--------------------------|
| | | | | | |

SCHEDULE C.

Form I.

(Section 21.)

Declaration.

——— Estate in the District of ———.

I hereby declare, in terms of section 21 of Ordinance No. 13 of 1889, as amended by "The Indian Coolies' Ordinance, 1909," that the wages of the labourers employed on the above-named estate for the month ending the ——— day of ———, 19—, have been duly paid in accordance with the requirements of the said Ordinance.

(Signed) ———,

Superintendent.

Dated the ——— day of ———, 19—,

Form II.

(Section 22.)

Register of Labourers.

Number : ———.

Name : ———.

Approximate age : ———.

Sex : ———.

Race and caste : ———.

Village : ———.

Taluk : ———.

District : ———.

Father's name : ———.

Mother's name : ———.

Height, viz., tall, short, or medium : ———.

Colour, viz., dark, light or medium : ———.

Distinguishing marks (if any) : ———.

General appearance: _____
 Kanganji's name: _____
 Date of engagement: _____
 Estate where last employed: _____
 Unliquidated liability, if any, to other estates: _____
 Whether employed permanently, or on contract work, or on both: _____
 Number of Ragama certificate (if any): _____.

Form III.

(Section 24.)

Discharge Ticket.

In pursuance of section 24 of Ordinance No. 13 of 1889, as amended by "The Indian Coolies' Ordinance, 1909," this is to certify that the labourer whose name and description are appended has been duly discharged from my service.

- (1) This labourer -
- (a) Was one of the coolies on my original register.
 - (b) Came to me with a certificate from the Cooly Depot.
 - (c) Came to me on Discharge Ticket from _____ Estate in the _____ District.
 - (d) Came to me on notice from _____ Estate in the _____ District with unliquidated liability amounting to Rs. _____.
 - (e) Came to me with a certificate from the Police Magistrate at _____.
- (2) The reason for his discharge is _____.

Description of Labourer.

(As above.)

(Signed) _____,
 Superintendent.

_____ Estate _____, District.

Dated _____, 19__.

Form IV.

(Section 24 (3).)

Memorandum with regard to Labourer leaving on Notice.
 _____ Estate _____, District.

Memorandum that the labourer whose name and description are appended hereto left this estate on the _____ day of _____, 19__.

and that a formal Discharge Ticket will be issued to his employer on application. The amount of his [or her] unliquidated liability is Rs. ———,

Date : ———, 19—, (Signed) ———,
Superintendent.

Name and Description of Labourer.

Name : ———. Father's name : ———,
Sex : ———. General appearance : ———.

Note.—In the case of a gang of labourers leaving on notice add the following particulars :—

- (1) Name of Kangani of gang : ———.
- (2) Amount of collective unliquidated liability of gang : ———.

Form V.

(Section 25.)

No. of Certificate.

Ragama Certificate.

I hereby certify that the labourer whose name and description are appended was despatched from the Depot at Ragama to ——— Estate on the ——— day of ———, 19—.

Name and Description of Labourer.

(As above.)

Dated ———, 19—. (Signed) ———,
Superintendent.

Form VI.

(Section 26.)

Certificate of Police Magistrate.

Police Court of ———.

I hereby certify, in terms of section 26 of Ordinance No. 13 of 1889, as amended by "The Indian Coolie's Ordinance, 1909," that I am satisfied that the labourer whose name and description are appended has not been employed on any estate in Ceylon during the thirty-six months immediately preceding the date of this certificate (or has left ——— estate on reasonable grounds.)

Description of Labourer.

(As above.)

Dated ———, 19—. (Signed) ———,
Police Magistrate.

RATES OF AGENCY, COMMISSION, AND BROKERAGE.**As appointed by the Chamber of Commerce.***(In force from 1st January, 1901.)***(a) RATES OF AGENCY, AND COMMISSION.**

| | <i>Per cent,</i> |
|---|------------------|
| On the sale, purchase or shipment of specie or bullion ... | 1 |
| On the sale or purchase of opium, diamonds, pearls, precious stones and jewellery of all descriptions | 2½ |
| On the sale or purchase of live stock | 5 |
| On the sale or purchase of goods or produce made with the proceeds of goods on which a commission of 5 per cent. has been previously charged | 2½ |
| On the sale or purchase of bank or joint stock shares, or Government Securities | 1 |
| On goods or produce entrusted to an agent for sale or shipment and afterwards withdrawn | 2½ |
| On goods or produce shipped only, or on delivery of the same to order | 2½ |
| On the sale or purchase (including shipment if required) of all other goods or produce not enumerated above | 5 |
| On sale or purchase of ships, houses or lands | 2½ |

Insurance.

| | |
|--|----|
| On procuring settlement of insurance losses, whether partial or total, on behalf of the insured, on the amount recovered | 2½ |
| On settling insurance as Agents for the Underwriters or Insurance Companies | 2½ |
| On certifying vouchers or claims against Companies on policies (marine) payable out of Ceylon, Rs. 50 | |
| On drawing up average adjustment, Rs. 50 | |
| On refund of deposits of general average contribution 2½ per cent. minimum Rs. 25. | |

Receiving and delivering Goods and Live Stock.

| | |
|---|----|
| On attending the delivery of contract, goods, or on receiving and delivering goods or live stock on the value thereof ... | 2½ |
|---|----|

(b) RATES OF BROKERAGE

| | |
|--|----|
| On effecting loans, mortgages or sales of land, estates and property. | 2½ |
|--|----|

| | <i>Per cent.</i> |
|---|---------------------|
| On sale of coffee, cocoa, poonac, cinnamon, plumbago, copra, cardamoms, and tea | 1 |
| On sale of coconut oil f o.b. Rs. 1.25 per ton | Naked Rs. 1 per ton |
| On sale of bills of exchange | 1/16 per cent. |
| On amount of freight obtained 1 per cent. (with a minimum of 25 cts. per ton.) | |
| On the sale of Bank or Joint stock shares | 1 „ „ |
| The seller shall pay the brokerage except in the case of Government Stock when $\frac{1}{2}$ per cent. is to be charged to the buyer and $\frac{1}{4}$ per cent. to the seller. | |

NATIVE NAMES OF BIRDS PROHIBITED TO BE EXPORTED.

Birds not to be
exported.

Under Ordinance 1 of 1909.

| ENGLISH NAMES. | SINHALESE NAMES. | TAMIL NAMES. |
|------------------------------|-------------------|--|
| Kingfisher ... | Pilihuduwa ... | Viehuli, Minkotti, Kalavaik-kuruvi |
| Egret, large, white ... | Badadel-koka ... | Vellai-kokku |
| Egret, little ... | Sudu-koka ... | Sinna Vellai-kokku |
| Egret, plumed ... | Sudu-koka ... | Peru-Vellai-kokku |
| Oriole, blackheaded ... | Kaha-kurulla ... | Mampala-kuruvi, Mancholi, Manchal-kuruvi |
| Woodpeckers ... | Kerala ... | Thachchan-kuruvi, Marankotti |
| Orange Minevet ... | Gini-kurulla ... | _____ |
| Trogon ... | Gini-kurulla ... | _____ |
| Paradise Fly Catcher... | Redi hora ... | Val-kuruvi, Eruthe valan |
| Painted Thrush ... | Avichechiya ... | Vannan-kuruvi, Sarikai |
| Indian Roller (Blue Jay) ... | Dun-kaluwa ... | Panang-kadai, Kadduk-kili |
| Hill (Brahmia) Myna ... | Hela-lihiniya ... | Maina |
| Hornbill ... | Kendatta ... | Iruwaik-kuruvi, Iruvaichechi |
| Teal, whistling ... | } Sera ... | Chenbatara, Sirakar |
| Teal, cotton ... | | |

**An Ordinance to make provision for preventing the introduction and spread of
Insect or Fungus Pests or Plant Diseases.**

Ordinance No. 5 of 1901.

1. This Ordinance may be cited as "The Insect Pest and Quarantine Ordinance."

2. In this Ordinance and any regulations made thereunder, unless the context otherwise requires—

"Plant" shall mean plants, trees, shrubs, buds, cuttings, grafts, scions, seeds, nursery stock and fruit, but shall not include canned or preserved fruits.

"Insect pest" shall signify any insect or other animal which the Governor may from time to time by Proclamation declare to be an insect pest within the meaning of this Ordinance.

"Fungus pest" shall signify any fungus which the Governor may from time to time by Proclamation declare to be a fungus pest within the meaning of this Ordinance.

"Plant disease" shall mean any other disease which the Governor may from time to time declare to be a plant disease within the meaning of this Ordinance.

3. The Governor, with the advice of the Executive Council, may from time to time make, and when made revoke or vary, such regulations as may seem necessary or expedient for the purpose of preventing the introduction into this Island of any insect pest, fungus pest, and plant disease, and also preventing the spread of any such pest or disease.

4. (1) The regulations made under the last preceding section may provide amongst other things:

Regulations
may provide
prohibition of
import of
landing.

(a) For prohibiting the importation into this Island from places beyond sea of any plants.

(b) For prohibiting the landing of plants from vessels or boats either absolutely or conditionally.

(c) For cleansing or disinfecting by the consignee in the manner prescribed by and to the satisfaction of the Director, Royal Botanical Gardens, and if expedient destroying, without compensation, all plants or the packages, cases, pots, or coverings in which they may be packed, which shall be found or suspected to be infected with any insect or fungus or plant disease.

For cleansing or
destroying
suspected
plants.

6. If any person is guilty of offence against this Ordinance, he shall be liable on conviction before a Police Magistrate to imprisonment of either description for a term not exceeding—

Offences, how
punishable.

ing six months or to a fine not exceeding one thousand rupees, or to both.

7. All regulations made under this Ordinance shall be published in the *Government Gazette*, and shall from the date of such publication have the same force as if they had been enacted in this Ordinance.

Regulations under Section 3 of "The Insect Pest and Quarantine Ordinance."

1. The importation of Cacao "plants" from any part of the Dutch East India Colonies is prohibited.
2. The Principal Collector of Customs shall destroy all Cacao "plants" imported from any part of the Dutch East Indian Colonies, and no compensation shall be payable in consequence of such destruction.

1. From the 1st day of September, 1906, and until further notice, all imported living trees, plants, tubers, roots, bulbs, or portions thereof (with the exception of potatoes, onions, ginger, turmeric, and culinary vegetables imported for consumption), and the fruits specified in section 2, with the packages, cases, pots, or covering in which they may be packed, shall—before being handed over to the consignee—be subject to treatment with hydrocyanic acid gas, or to such other treatment as may be deemed necessary by the Government Entomologist at the Government Fumigatorium at Kochchikade.

2. The following fruits shall be subject to fumigation as directed, viz., oranges, lemons, citrons, limes, and all fruits of the Citrus family.

3. The said plants, fruits, etc., shall be landed at the Customs premises at Kochchikade and delivered to the Fumigatorium Attendant, who shall give a receipt for the same.

4. As soon as possible after receipt of the articles the Fumigatorium Attendant shall cause them to be fumigated according to the approved directions (to be framed and hung in the Fumigatorium).

5. After treatment the articles shall be delivered to the consignee together with a certificate showing that they have been so treated.

6. Without such certificate it shall be illegal to convey the prescribed articles from the Fumigatorium.

7. The consignee must have an agent in attendance to unpack the articles for fumigation and to re-pack them afterwards.

8. Wardian cases and other securely closed packages of plant, etc., addressed to the Director, Royal Botanic Gardens, or to any subordinate officials, shall be forwarded direct to Peradeniya, where they will be fumigated under the direction of the Government Entomologist.

9. A certificate of fumigation by some properly constituted authority at the port of shipment will be accepted as exempting fruit or plants from further treatment; but a certificate or mere inspection will not be so accepted.

1. No tea seed shall be imported into Ceylon from any place in India, except at the port of Colombo.

2. All tea seed imported into Ceylon from any place in India shall be subjected to a process of disinfection in Colombo, unless accompanied by a certificate from a Scientific Officer either of the India Tea Association or of the Imperial Department of Agriculture to the effect that the leaf disease called Blister Blight (*Exobasidium vaxans*) does not exist within a radius of 10 miles of the estate or garden on which the seed was grown.

3. Tea seed imported from any place in India shall not be admitted into Ceylon if packed in soil.

4. The process of disinfection will be carried out at the risk of the consignee.

Regulations under Section 4 (a) of "The Insect Pest and Quarantine Ordinance, 1901."

1. From and after the date hereof it shall be unlawful for any person to import or cause the importation of the Water Hyacinth plant (*Eichhornia crassipes*) into Ceylon.

2. It shall be lawful for the Principal Collector or any officer of Customs to destroy on landing all Water Hyacinth plants imported into Ceylon; and no compensation shall be payable in consequence of such destruction.

The *modus operandi* in fumigating Fruit, Plants and Tea Seed is as follows:—

Fruit.—The covers of the cases are removed, and if the fruit is loose in the cases without other packing the open

cases are placed directly in the Chamber, otherwise the fruit has to be taken out and placed on the trays on the rack. Thin paper wrappers are not removed. After the fruit has been arranged in the room the vessels containing water and Sulphuric Acid are placed in position, and immediately before closing the doors Cyanide of Potassium, broken into small lumps and wrapped in paper, is dropped. The Chambers are tightly closed for half an hour, after which time the ventilators and windows are opened from outside, but the contents of the Chamber are not removed for at least another quarter of an hour.

Plants. The same process as for fumigating fruits. Plants in pots are placed either on the floor or on the racks. Living plants should not be watered immediately before fumigation. Wet foliage is liable to be injured by the gas. After removal of the plants they should be protected from the sun for several hours, preferably until the following morning.

Tea Seed.—The seed is placed on the trays with as little of the packing material as possible. The latter is placed separately on the other trays. A quantity of *Potassium Permanganate* is put into an empty kerosine tin, to which is added a small quantity of *Formalin* according to the size of the Chamber used. The door is then closed and so left for three-quarters of an hour. The seed is then returned to the sender, and should be spread out and left exposed till all the smell is gone.

Extracts from Regulations Relating to Equine Diseases.

Under Section 9 of Ordinance No. 25 of 1909.

Any officer appointed under the Ordinance who is specially authorized by the Government Agent for the purpose, or any other person so authorized, may destroy without compensation any animal landed from oversea ports showing definite evidence of disease, provided that if the owner gives immediate notice in writing to the Government Agent that he objects to the animal being destroyed, it shall not be destroyed, except with the special authority of the Government Agent first obtained.

Compensation may be paid out of moneys voted by the Legislative Council in respect of animals destroyed under these regulations, such amount shall be half the assessed value of the animal immediately before it was destroyed, so

that the sum paid shall not exceed Rs. 350 for any horse or Rs. 75 for any ass or mule.

The value of an animal for the purpose of compensation shall be determined by a Board consisting of three members of which one shall be the Government Veterinary Surgeon, with two others appointed by the Government Agent.

All expenses in connection with feeding, watering and detention, or application of diagnostic tests under these regulations shall be defrayed by the owner or person in charge of the animals, and on failure thereof it shall be lawful for any person duly authorized by the principal officer of Customs or Government Agent to incur such expenses, and the amount of expenses incurred in that behalf when certified under the hand of the principal officer of Customs or Government Agent to the nearest Police Magistrate shall be recoverable from the owner or person in charge of such animals as if it were a fine imposed by such Magistrate.

Veterinary practitioners shall report any case of equine disease under their charge, and shall be entitled to a fee of Rs. 2-50 for each report, provided the case is positive.

An Ordinance to amend "The Rabies Ordinance, 1893."

Extracts from Ordinance No. 7 of 1906.

Any person who knowingly imports or attempts to import any dog, horse, deer, or any other animal contrary to the prohibition or order contained in such Proclamation shall be guilty of an offence, and shall be liable on conviction thereof to a fine not exceeding one hundred rupees; or in default to simple imprisonment for a period not exceeding three months.

Regulations under Section 12 A (1).

30th July, 1910. Prohibits the importation into Ceylon of dogs from India or Japan.

2nd December, 1910. Prohibits the importation into Ceylon of dogs from Java, China, the Straits Settlements and the Federated Malay States.

RULES RELATING TO FACTORIES.

Promulgated in the "Ceylon Government Gazette" No. 6,431 of March 17, 1911.

In these rules, unless the context otherwise requires—

Terms defined. "Child" means a person under the age of 14 years.
 "Young person" means a person of the age of 14 years and under the age of 18 years.

"Woman" means a woman of 18 years of age and upwards.

"Machinery" includes any driving strap or band.

"Mill-gearing" comprehends every shaft, whether upright, oblique, or horizontal, and every wheel, drum, or pulley by which the motion of the first moving power is communicated to any machine.

29. Every hoist or tackle, near to which any person is liable to pass or to be employed, and every wheel, if within a distance of 3 ft. 6 in. from the floor, directly connected with steam, water, electrical or other mechanical power, whether in the engine-house or not, and every part of a steam, gas, or oil engine, electrical motor, dynamo, or water wheel, shall be securely fenced; and

30. Every wheel-race not otherwise secured shall be securely fenced close to the edge thereof.

31. Every part of the mill-gearing, belting, ropes, or chains driven in any way whatever within a distance of 3 ft. 6 in. from the floor shall either be securely fenced or be in such a position or of such construction as to be as safe to every person employed in the factory as it would be if it were securely fenced.

32. All fencing shall be of wood 3 ft. 6 in. high, posts 3 in. by 3 in., top rail 3 in. by 2 in., intermediate rails, two in number, 2 in. by 1½ in. If iron is used for rails, it must be not less than 1 in. in diameter, and shall be maintained in an efficient state while the parts required to be fenced are in motion.

33. All wires conveying electrical current from the dynamo to the motors or lamps shall have highly insulated covering so as to constitute no source of danger.

34. Every main switchboard shall be under lock and key and bear clear instructions for its use by the inexperienced.

35. No child shall be allowed to clean any part of the machinery in the factory while the same is in motion.

36. No young person or woman shall be allowed to clean any mill gearing belts, ropes, or chains conveying motive power from the driving to the driven machine while the same is in motion.

No child or young person's life to be jeopardised.

37. No child, young person, or woman shall be allowed to work between fixed and traversing parts of any self-acting machine while the machine is in motion.

38. No superintendent or manager of a factory shall allow any boiler to be used for generating steam for the purpose of driving machinery, unless he can produce a boiler certificate in the annexed Form D from an engineer specially licensed by Government to issue certificates as to fitness of boilers and competency of persons in charge thereof.

No boiler to be used unless certificated.

On or before June 30 in each year it shall be the duty of all superintendents and managers of factories in which boilers are used as aforesaid to report in writing to the Government Agent of the Province the names and situation of the factories in their charge, together with a copy of certificate in Form D of an engineer specially licensed by Government to issue certificates as to fitness of boilers and competency of persons in charge thereof for each boiler, and the Government Agent shall cause the same to be registered and numbered informing the manager or superintendent of the number assigned to each factory. When any new factory in which a boiler is used as aforesaid is opened, or whenever a new boiler is erected in a factory after the said date, the superintendent or manager shall forthwith report the same, with copy of boiler certificate in manner aforesaid, and at the same time report the opening of the new factory or the erection of a new boiler to the Inspector of Factories.

Annual report required to be sent to G. A.

New factory or new boiler to be reported to G. A. and Inspector of Factories.

Whenever the steam power in any factory is permanently discarded or done away with, the superintendent or manager shall forthwith report the same to the Government Agent of the Province and to the Inspector of Factories.

Abandonment of steam power to be reported.

The certificate in Form D must be obtained annually from a licensed engineer, who shall inspect such boiler before the issue of each certificate. From D to be kept in triplicate: one copy to be kept in the factory for the information of the Inspector of Factories, one to be sent to the Government Agent, and the third to be retained by the licensing engineer.

Annual certificate to be obtained from Engineer.

Certificates to be kept in factory. All original certificates of boilers to be kept in the factory for the information of the Inspector of Factories. No superintendent or manager shall allow any boiler to be used as aforesaid beyond the period specified or in excess of the time stated in the boiler certificate in Form D.

Form F, to be delivered when new factory opened. It shall be the duty of all superintendents and managers of factories when any new factory in their charge is opened in which mechanical motive power is made use of, to cause to be delivered to the Government Agent of the Province and to the Inspector of Factories, within one month of the commencement of work, a notice substantially in Form F annexed intimating that work has been commenced.

Control of boiler limited to certificated persons. 39. No superintendent or manager shall allow any person to have, nor shall any person have, control over a boiler used as aforesaid, unless he can produce a certificate of competency in the annexed Form A from the Inspecting Engineer appointed by Government, or from an engineer specially licensed by Government to issue certificates as to fitness of boilers and competency of persons in charge thereof.

Copies of certificates to be sent to G. A. each year. Superintendents and managers shall on or before June 30 in each year forward to the Government Agent of their Province the copies of the certificates of competency of all persons in their employment, and shall also forward to the Government Agent the copies of certificates of all persons whom they may subsequently allow to have control of any boiler.

Certificates of competency to be kept in factory. The original or copy of certificate of competency to be kept in the factory for the information of the Inspector of Factories.

Inspectors to have free access. 40. All persons specially authorized in writing thereto by the Government shall be Inspectors for the purposes of Ordinance No. 2 of 1896 in respect of such factories as shall be enumerated upon such written authority, and shall at all reasonable hours of the day have free access to such factories for the purposes of inspecting machinery in use therein, or any part thereof, and shall report to the Government Agent any failure to comply with the provisions of these rules.

Inspectors to report once a year. The Inspectors thus appointed shall furnish once a year, if possible, a report on each factory in their charge and forward it to the Government Agent, on or before the date appointed by that officer, accompanied either by a certificate in the annexed Form B. (Certificate of Inspection) or by a statement showing why the Inspector is unable to grant such certificate.

41. The manager or the engineer in charge of a factory in which mechanical motive power and connected machinery are made use of shall on or before June 30 in each year forward to the Government Agent of the Province in which the factory is situated a certificate in the annexed Form C that these rules have been complied with. Where the rules have not been complied with in all respects, the manager or engineer shall name the particulars in which the rules have not been complied with and shall state the reason for such non-compliance.

Manager or Engineer to certify each year.

Form E to be forwarded on cessation of work.

It shall be the duty of all superintendents or managers of factories to cause to be delivered to the Government Agent of the Province and to the Inspector of Factories, within one month of the cessation of work, a notice, substantially in the Form E annexed, intimating that work in the factory has been stopped.

Form F to be forwarded on resumption.

If work is resumed in the factory, a notice, substantially in Form F annexed, must be sent to the Government Agent of the Province and to the Inspector of Factories, within one month of the resumption of work intimating that work has been re-commenced.

42. Upon receipt of the certificate referred to in rule 39 the Government Agent shall forward a copy thereof to the person with regard to whom the certificate is given. Where a copy of the certificate has been received, the Government Agent shall forward a duplicate thereof.

G. A. to supply copies of certificates.

43. It shall be lawful for the Government Agent, when he is satisfied that any part of the machinery of a factory is a source of danger to any person or persons employed therein, to make an order in writing directing that such protective measures as he may think necessary be taken in regard to such part of the machinery.

G. A. may order protective measures.

44. The manager or superintendent shall carry out such order as quickly as possible, unless he lodges within ten days of the receipt of the order an appeal against the order to the Governor in Executive Council, by whom the order may be confirmed, modified, or annulled.

Order to be carried out unless appealed from.

45. The superintendent or manager shall comply with the order which may be made by the Governor within two weeks of the receipt of a communication containing the decision arrived at.

Governor's order to be carried out.

46. Nothing in these rules shall be read or construed to preclude a special inspection being made of any factory at any time within reasonable hours by any person duly and specially authorized by the Government Agent to make such special inspection.

47. The superintendent or manager shall place a copy of these rules in a conspicuous position near the door of the factory.

48. The owner, superintendent, manager, or person in charge of a factory shall cause to be sent by telegram or by registered post to the Government Agent information of the occurrence of any accident to any workman resulting in death or serious injury within twenty-four hours of such occurrence.

Form A (Certificate of Competency).

I, the undersigned (being an engineer especially licensed under the provisions of Ordinance No. 2 of 1896), do hereby certify that—, whose description is on the back of this certificate, and who is now in charge of the boilers in Factory No.—, known as —, in the village —, in — korale of the — Province, is to the best of my knowledge and belief a suitable and capable person to have control of boilers in which steam is generated for the purpose of driving machinery.

On the other side of the certificate the following particulars shall be inserted:—

Name in full:—.

Birthplace:—.

Age:—.

Nationality:—.

Complexion:—.

Height:—.

Thumb and finger marks of both hands:—.

Date:—, 191—.

Signature:—.

The original or copy of certificate of competency to be kept in the factory for the information of the Inspector of Factories.

Form B (Certificate of Inspection).

I, the undersigned, do hereby certify that on the — day of —, 191—, I inspected the machinery in Factory No.— known as — Factory, situated in the village —, in — korale of the — Province, that (here state whether the provisions of Ordinance No. 2 of 1896 and the rules thereunder

have been duly observed, and if not, in what particulars default has been made), and that the boiler used in the factory was in charge of ———, who held Certificate of Competency, No. ———, dated ———, from ———, and that a Boiler Certificate, dated the ——— day of ———, 191—, on Form D, signed by ———, a qualified engineer licensed under the Ordinance No. 2 of 1896, was in the possession of the Superintendent and produced for my inspection.

Date : ———, 191—.

Signature : ———

Form C (Certificate of Compliance).

I, the undersigned, hereby certify to the best of my knowledge and belief that the rules published in the *Ceylon Government Gazette* No. 6,431 of March 17, 1911, under section 4 of Ordinance No. 2 of 1896, are being complied with in the Factory No. ——— known as ——— Factory, and situated in the village ———, in ——— korale of the ——— Province, and that as far as I can discover they have been complied with.

Date : ———191—.

Signature : ———.

The form to be in duplicate, one copy to be kept in the Kacheheri.

Form D (Boiler Certificate).

Name of factory : ———.

No. ———.

Village : ———.

Form D.

Name of Manager : ———.

Type of boiler : ———.

Approximate horse power : —.

Condition of boiler externally : ———.

Condition of boiler internally : ———.

Condition of boiler mountings : ———.

Condition of boiler safety valve : ———.

Condition of boiler stop valve : ———.

Condition of boiler fusible plug : ———.

Condition of boiler feed pump or injector : ———.

Maker's name : ———.

I, ———, being a duly qualified engineer licensed under the provisions of Ordinance No. 2 of 1896, certify that on the ——— day of ———, 191—, I personally inspected the above boiler and found it as above stated. The boiler, in my opinion, is safe with ordinary care for a

working pressure of — pounds per square inch for a period of — months from this date, and that the pressure at which the safety valve is set to blow off, — pounds per square inch, must not on any account be exceeded.

Date: —, 191—.

Signature: —.

This certificate, Form D. to be kept in the factory for the information of the Inspector of Factories.

Form E. (Form of Report).

I, —, Manager of — Factory, No.—, situated near —
 Form E. post station, in — district of — Province, do hereby give notice that work ceased in the aforesaid Factory on the — day of —, 191—.

The reasons for stopping work are as follows: —

Date: —, 191—.

Place: —.

(Signed) —.

It is, however, my intention to resume work in the aforesaid factory on or about the — day of —, 191—.

(Signed) —.

Form F (Form of Report).

I, —, Manager of — Factory, No.—, situated within
 Form F. — miles of — post station, in — district of — Province, do hereby give notice that work commenced in the aforesaid Factory on the — day of —, 191—.

Date: —, 191—.

Place: —.

(Signed) —.

CARE OF BOILERS.

- (1) Warm boiler gradually. Do not get up steam from cold water in less than four hours.
- (2) Moderately thick fires are most economical. Fire evenly and regularly, a little at a time. Do not clean fire oftener than necessary, and keep fire door open as short a time as possible.
- (3) Cleaning must be done thoroughly inside and outside. This frequency of cleaning will depend upon the nature of fuel and water; but the boiler ought to be opened at least every two months.
- (4) Never fill a hot boiler with cold water.
- (5) The dirty water should be blown off every morning; allow the cock to stand open for two or three minutes when the steam pressure is about 5 lbs.

FIXTURES.

There seems to be a good deal of misunderstanding on the part of tenants as to fixtures. Not infrequently does it happen that a tenant improves the property of the landlord for his own convenience and, when leaving, believes he has every right to remove the improvements. For the guidance of readers the Law obtaining in Ceylon with regard to fixtures may be briefly stated thus:—Improvements made by a tenant during his temporary occupation may be either removed by the tenant, or the tenant can claim compensation for the value of the improvements; but the removal by the tenant must be in such a manner as not to damage the main building.



NOTES

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ELECTRIC LIGHTING INSTALLATIONS FOR ESTATES.

The electric light as an illuminant for estate factories and bungalows has steadily increased in popularity, as its superiority over other methods of lighting became demonstrated, and it is no exaggeration to state that no factory can be considered up-to-date that is not equipped with an electric lighting installation, displacing inefficient and dangerous methods of lighting, such as Kerosine oil lamps, the disadvantages of which are generally recognised by users, and Fire Insurance Offices.

The use of electricity will increase as its merits and conveniences become more fully recognised, and it has already become one of the essentials in the equipment of a modern factory. The high efficiency lamps, introduced within the past few years, have given a great impetus to the electric lighting of factories and bungalows, by reducing the cost of installation and upkeep, and at the same time affording a much better light. Improvements in lamp efficiencies are continually being made, and with the use of the "half watt" lamp, now being perfected for moderate candle powers, a further reduction in first cost and upkeep charges is assured.

The cost of an electric lighting installation varies according to the system adopted, but may generally be taken as approximately Rs. 2,500-00 for a factory, including dynamo, switchboard, wiring and about 30 lamps, where the dynamo is driven from the factory shafting. If the dynamo is driven independently from the shafting, the cost of the pelton, turbine, or engine, used for the purpose must be added to the above. In most cases lighting is required for the estate bungalow in addition to the factory and in that event it is convenient to use accumulators, which are charged during the day-time when the factory is working, and discharged on the bungalow lighting installation at night when the factory is shut down.

Choice of System.—The systems of lighting generally in use are:—

1. Dynamo driven from factory shafting for factory lighting only.

2. Dynamo driven from factory shafting, with battery of accumulators for factory and bungalow lighting when factory is shut down.
3. Dynamo driven by separate pelton, turbine or engine.

The latter is by far the most satisfactory method and should be adopted wherever possible, as the installation is then entirely independent from the working of the factory, can be used at any time, and is free from fluctuation in the light due to varying speed of factory shafting, and from the trouble of attending to accumulators.

Where it is not possible to have an independently driven dynamo, and lamps are required in the factory and bungalow after the factory engine has been stopped, accumulators will be necessary; these add considerably to the first cost of the installation, and require careful attention to obtain satisfactory working results, their use is, however, fairly general on account of the convenience of having the lights available when the factory is not working, and where bungalow lighting is required, the first cost can be considerably reduced by having a small battery of accumulators in the bungalow, charged from the factory dynamo in the day-time, and using low voltage lamps on the bungalow installation only. A typical installation of this kind with factory and bungalow lighting would cost about Rs. 3,000-00 complete, allowing 30 lights in the factory and 20 in the bungalow.

The system generally used for factories is the direct current at a voltage, or pressure, of about 100, this affording safety in operation, and reasonable economy in wiring material, while direct current is essential where accumulators are used.

Power Required for Lighting—May be taken at approximately one horse power for every twenty metallic filament lamps of twenty candle power each, *i.e.*, one horse power for 400 candle power. With the new "half watt" lamps, the power required will be about half the above for the same candle power. In practice it will be found that not more than half of the number of lamps installed are lighted at one time, and this should be taken into consideration when ascertaining the power available for an electric lighting scheme. Ordinarily from 2 to 3 horse power will be found quite sufficient for the usual factory and bungalow installations.

Lamps.—The metallic filament lamps of the "Osram," "Mazda" or other well-known types are the most commonly used for factory installations, as they combine a reasonably long "life" with good economy, their efficiency is about $1\frac{1}{2}$ watt per candle power, and

they give very satisfactory results. The half watt nitrogen filled lamps give nearly twice the light for the same expenditure of energy as the ordinary metallic filament lamps and for use with accumulator systems they effect a great economy in the size of the battery required: The light is of much whiter quality than that of the metallic filament lamp and the life of the half watt lamp is not so long but it will be found entirely satisfactory for use on low voltage circuits such as bungalow lighting at 25 volts; for the latter, lamps of 20 candle power will generally be found quite large enough, while for factories it is advisable to use at least 50 candle power lamps, for where light is required for industrial purposes the better the illumination the better the work is likely to be.

Methods of Wiring. Wherever possible the "loop-in," or jointless, system of wiring should be specified, this means that instead of the wires being jointed they are looped from the fittings of one lamp to those of the next; the wiring should be on the cleat or open system, *i.e.*, supported on porcelain cleats at frequent intervals, or else in teak casing, the former system being preferable wherever it can be adopted. Where casing is used it should be separated from walls and partitions by small insulators, except in very dry situations. For the lighting of withering lofts and sheds the most convenient method will be to use connecting plugs and hand lamps with flexible connections instead of fixed lamps.

Cables and Wires.—Only the best class of cables and wires should be specified, and should not in any case be of lower class than the Cable makers' association 600 megohm permile grade. The current density should not, except in special cases, exceed 1,000 amperes per square inch: The current carrying capacity of the sizes of wires and cables most generally used are as follows at the above current density:—

TABLE I.

| | |
|-----------------------------|--------------|
| 1/18 S.W.G. and 3/22 S.W.G. | 1.8 amperes. |
| 1/16 S.W.G. and 3/20 S.W.G. | 3.2 „ |
| 1/14 S.W.G. | 5 „ |
| 7/20 S.W.G. | 7 „ |
| 7/18 S.W.G. | 12.5 „ |
| 7/16 S.W.G. | 23 „ |

Fuses.—Care should be taken to see that suitable safety fuses are used in all circuits to prevent overloading of cables, and consequent risk of overheating. In no case should melted fuses be replaced by thick pieces of copper wire as this practice involves danger of causing overheating of cables, and fires in case of faults developing on the wiring. For

ordinary 100 volt 50 candle power metallic filament lamp circuits it would be safe to allow one ampere of fuse capacity per lamp on the circuit controlled by any individual fuse, the sizes of fuse wire usually employed being as follows:—

| Fusing current. | Copper. | Tin. | Lead. |
|-----------------|-----------|-----------|-----------|
| 2 amp. | 43 S.W.G. | 31 S.W.G. | 30 S.W.G. |
| 5 „ | 38 S.W.G. | 25 S.W.G. | 23 S.W.G. |
| 10 „ | 34 S.W.G. | 2 S.W.G. | 20 S.W.G. |
| 15 „ | 30 S.W.G. | 19 S.W.G. | 18 S.W.G. |
| 20 „ | 27 S.W.G. | 17 S.W.G. | 17 S.W.G. |
| 30 „ | 25 S.W.G. | 15 S.W.G. | 14 S.W.G. |
| 40 „ | 23 S.W.G. | 14 S.W.G. | 13 S.W.G. |

Care of Dynamo.—Dynamos are usually lubricated on the ring and oil well principle. A loose ring is fitted round the shaft, and such ring, revolving in a well of oil, delivers oil on to the shaft, which runs along same, over the whole surface of the bearings.

If any bearing of a new dynamo becomes hot, and the oil ring appears to be working alright, the cause of the heat is generally due to dirt. Have the whole of the oil removed from the well, and clean the bearing out well with kerosine, filling afterwards with new lubricating oil. Dynamos are generally high speed machines and the lubricating oil should not be too thick.

Bearings very often heat up through the “sticking” of the oil ring, and these rings should be frequently examined whilst the dynamo is running, to see they are revolving. If they are “sticking” they can easily be released, by touching same, but frequent “sticking” points to too thick or dirty oil.

The oil in the wells should be changed every few months, as it loses its lubricating qualities, with usage, to a certain extent.

The bearings should be watched for wear, for the clearance between the armature and the field poles is very small, and should the armature drop to such an extent as to allow it to scrape the poles, extensive damage will ensue.

The commutators, brushes, and in fact the whole dynamo should always be kept in a cleanly condition. The commutator can be cleaned by lifting the brushes off same, and holding sand paper, followed by a kerosined rag, against same whilst dynamo is revolving. Unless the commutator is exceptionally dirty the kerosined rag should be sufficient to give same a bright surface.

A fair amount of wear takes place on the brushes, and a spare set should always be kept in stock, do not allow the brushes to press too heavily on the commutator.

Keep all wires round the dynamo and switchboard, carefully and neatly fastened, and see that all connections are kept tight.

Care of Accumulators.—Accumulators do not need very much attention, but such attention should be regular and trustworthy.

The accumulator plates are immersed in a mixture of sulphuric acid and water (only distilled, or rain water must be used) of a specific gravity of 1·200. Full directions for charging and maintenance are always given by the makers.

When discharged, the specific gravity of any cell will drop to 1·150, but will rise again to 1·200 on the cell being charged. This difference between the specific gravity readings (taken by a hydrometer, supplied with the battery) is the register of the condition of the cell. Specific gravity readings, before and after, charges should be taken, at every charge, and records kept. A specimen record is herewith given :—

SPECIFIC GRAVITY READINGS.

| Dates. | | March 16th, 1917. | | March 19th, 1917. | | March 23rd, 1917. | |
|----------|---------|-------------------|---------|-------------------|---------|-------------------|--|
| Cell No. | Before. | After. | Before. | After. | Before. | After. | |
| 1 | 1·150 | 1·200 | 1·140 | 1·200 | 1·150 | 1·200 | |
| 2 | 1·150 | 1·200 | 1·160 | 1·200 | 1·150 | 1·200 | |
| 3 | 1·160 | 1·210 | 1·130 | 1·190 | 1·150 | 1·200 | |
| — | — | — | — | — | — | — | |
| 13 | 1·140 | 1·180 | 1·120 | 1·120 | 1·150 | 1·200 | |

From the above table it will be noticed that cell No. 13 did not rise in specific gravity during the charge. This cell must, therefore, be out of order, and should be at once examined.

If the cells receive their proper charge the specific gravity must rise, providing there is nothing wrong with any cell.

On completion of the charge the *voltage* of each cell will be approximately 2·2; this soon falls to 2 volts per cell, and care should be taken to see that they are not discharged below 1·8 volts per cell.

Over-discharging is one of the commonest causes of trouble, and should be guarded against as far as possible—another common fault is internal ‘‘short-circuiting’’ of the plates, either from the plates them-

selves distorting or "buckling," or due to small metallic particles detaching themselves from the plates and collecting at the bottom of the cell, or wedging themselves between adjacent plates, thereby preventing them from obtaining the requisite amount of charge, and reducing their capacity to meet demands for discharge.

These and other troubles are liable to lead to serious consequences if neglected, but given careful and conscientious attention should be detected in their early stages, when, in common with other defects, their cure can be more economically and readily effected.

Owing to the gradual evaporation of the water in the cells, additional quantities should be added from time to time, care being taken to only use distilled, or rain, water for this purpose, to maintain the requisite amount of electrolyte (acid and water).

Idle Batteries.—Long periods of idleness have a bad effect on the cells, unless the electrolyte is withdrawn. Before doing this, however, the cells should be given a full charge, and the electrolyte having been drawn off, the most generally accepted practice is to refill the cells with water and then discharge them, after which the water should be removed.

From the foregoing observations, it will be gathered that cells require careful attention, and given same, they should prove efficient and useful adjuncts for electric lighting—the most important points to watch being to:—

- (1) Keep the cells filled with electrolyte.
- (2) Take regular and careful specific gravity readings.
- (3) Have the reason for the departure from the normal of any of the readings investigated; and
- (4) Follow absolutely the makers instructions for maintaining same.

TECHNICAL TERMS AND DEFINITIONS.

Ampere. The practical unit of electrical current.

Volt. do do do pressure.

Watt. do do do power.

(being the product of the ampere and the volt).

Electrical Horse Power = 746 watts.

Kilowatt = 1,000 watts. The Kilowatt is therefore approximately equivalent to $1\frac{1}{3}$ Electrical Horse Power.

INDEX.

| | PAGE | | PAGE |
|------------------------------|----------|------------------------------|--------|
| Abcess ... | 380 | Affirmation Ordinance | 407 |
| Absorptive Power of various | | Agency, Commission, Broker- | |
| Litters ... | 242 | age Rates .. | 435 |
| Acacia Dealbata ... | 28 | London and Colombo | |
| Decurrens ... | 28, 236 | Forwarding | 83 |
| Melanoxylon ... | 28 | Rates, Foreign parcel | 93 |
| Account, Cash Advances | 380 | Agreements for hire, Regula- | |
| Check Roll ... | 380 | tions re | 409 |
| Current ... | 374, 387 | Ailantus Malabarica ... | 32 |
| Expenditure ... | 375, 391 | Alignments of Horses ... | 366 |
| for Rubber, Payment | | Air, Saturated Mixtures of | 121 |
| on ... | 205 | Weight of | 9 |
| Sales, Rubber | 197 | Albizzia ... | 28 |
| Rubber Sale... | 390 | Moluccana ... | 236 |
| Tea Sales ... | 390 | Odoratissima ... | 31, 28 |
| Accounting, Short Cuts | 379 | Stipulata ... | 30, 28 |
| Accounts Macadam's System | 398 | Alcohol, Boiling point ... | 10 |
| Impersonal and Per- | | Aleuritis Trilobica ... | 32 |
| sonal ... | 370 | Almond ... | 254 |
| Acetic Acid, Uses for ... | 293 | Alstonia Sch. ... | 32 |
| Acid Boric, Uses of ... | 293 | Alternate day tapping of | |
| Acre, Number of Rubber trees | | Rubber ... | 167 |
| per ... | 162 | Alubo ... | 29 |
| of Land ... | 11 | Aluminium. Weight of | 9 |
| of Tea, Cost of works per | 89 | Amba ... | 79 |
| Tea Nursery, Cost of mak- | | America, Teas for ... | 123 |
| ing one .. | 105 | Ammonia, Sulphate of... | 247 |
| Acres, Cost of bringing into | | Amoora Rohituka ... | 30 |
| bearing, Rubber | 153 | Amount insured, Increase of | 338 |
| Cost of producing Tea | | of Working for Rub- | |
| on an estate of 400 | 113 | ber ... | 191 |
| of Coconut, Cost of | | Amunam ... | 11, 12 |
| bringing into bearing | 147 | Anæmia of Ceylon ... | 225 |
| Reducing square links to | 18 | Analyses of Farmyard Manures | 244 |
| Acronychia Laurifolia ... | 29 | Analysis of Ceylon Crop | 234 |
| Act, Food and Drugs ... | 132 | of Ceylon Soils | 233 |
| London Building... | 5 | of Tea Prunings | 116 |
| Acute Diarrhœa, Treatment | 283 | Anchyllostomiasis ... | 255 |
| Addition of Figures ... | 379 | Andunwenna ... | 32 |
| Adenanthera ... | 28, 30 | Angle for Shingle Roof | 66 |
| Aden, Duties on Tea at | 135 | to lay out right | 19 |
| Adult Vaccination Offences | 331 | Ankenda ... | 29 |
| Advances Account, Cash | 390 | Anisophyllea Zeylan ... | 31 |
| Advances, The Check Roll and | 372 | Anthrax ... | 349 |
| Advances, Coast ... | 375 | Antidote for Poisoning | 285 |
| Advantages of Double Entry | 369 | Antigua, Duties on Tea at | 135 |
| Aerial ropeways ... | 71 | Antipyrine, Uses of ... | 293 |

| PAGE | PAGE |
|---|---|
| Appendices Med. Wants Ord. 312 | Balsam of Peru ... 28 |
| Application for delivery on String Tenders 205 | Banana ... 254 |
| Applications for Rebate should be made, Form in ... 311 | Bank Book ... 370, 383 |
| Apportionment of Charges, Tea 120 | Barbados, Duties on Tea at 135 |
| Approx. Cost of Producing Tea 113 | Bark Rot on Tapped Surface 227 |
| " " Rubber 159 | Bark Shavings ... 189 |
| " " Rubber 159 | Barrel, Gallons in one 6 |
| " height Pumps may be worked ... 45 | Barrowcliff, M. ... 170 |
| Aqueous Vapour, Saturated mixture of ... 121 | Basalt, Weight of ... 9 |
| Arabia, Duties on Tea at 135 | Base Measurement, Superficial versus ... 5 |
| Arden, Stanley ... 166 | " Table for reducing hypotenuse to ... 7 |
| Are ... 8 | Basic Slag as a Tea Manure 248 |
| Area of Circle, Triangles Equivalent 18 | Baskets, Cost of Plucking and Transport ... 113 |
| " " on Plans, To find the 17 | Bassia Fulva ... 31 |
| " " To find without Triangles 21 | " Longifolia ... 30 |
| Areas, Computing ... 21 | " Neri ... 29 |
| Argentina, Duties on Tea at 135 | Bata-Damba ... 29 |
| Arnica, Tincture of ... 294 | Bates Engines ... 50 |
| Arrida ... 32 | Bath, When to ... 287 |
| Articles, Rules re Conveyance by Rail of Bulky and heavy 80 | Batta, Calculating ... 404 |
| " Rules re Conveyance by Rail of Small or loose 80 | Battens ... 69 |
| Artificers, Journeymen, Ordinance relating to ... 408 | Bearing Power of Soils, Safe 53 |
| Artocarpus ... 28, 29 | Cost of bringing Coconuts into 147 |
| " Integrifolia ... 30 | " Rubber into 153 |
| Asbestos, Paint ... 37 | Bees, Stings of Wasps and 293 |
| Ascertaining yield of Rubber for any Acreage ... 175 | Beetles, Coconut ... 149 |
| Asphalte, Weight of ... 9 | Beetle, Fungus Parasite of the Coconut ... 151 |
| Association, Recommendations, Rubber Growers ... 189 | Belgium, Duties on Tea at 135 |
| Australasia, Duties on Tea at 135 | Belting Balata ... 38 |
| Average, Composition of Tea 106 | " Camel Brand ... 38 |
| " Cost of Packages 123 | " Described ... 38 |
| " Work of a Cooly 161 | " Gandy's ... 38 |
| " Horse 39 | " Leather ... 38 |
| Avoidupois, Metric equivalent 8 | " Rosendales ... 38 |
| Azadirachta Indica ... 30 | " Scandinavia ... 38 |
| Bahamas , Duties on Tea at 135 | " To find width of 39 |
| Baines, A. L., Remarks by 168 | Belts, Holes in ... 38 |
| Bakmi ... 29 | " Long ... 38, 39 |
| Bala ... 29 | Bera, Equivalent Measurements 11 |
| Balance, Sheet ... 374 | Beraliya ... 29 |
| " Trial ... 374, 392 | Bermuda, Duties on Tea at 135 |
| Balata belting ... 38 | Berrya Ammonilla ... 28, 29 |
| | Birds Prohibited to be Exported 436 |
| | Births and Deaths Ordinance 407 |
| | Births and Deaths to be reported 406 |
| | Bismuth Subnitrate ... 293 |
| | Bisulphite Sodium ... 190 |
| | Bite Leech, Treatment 293 |
| | " of mad Dog, How to act 292 |

| PAGE | | PAGE | |
|------------------------------|----------|--------------------------------|---------|
| Bite Scorpion | 295 | Bridges, Prices of Steel road | 74 |
| „ Snake | 293, 295 | British East Africa, Duties on | |
| Black Coconut Beetle | 150 | Tea at | 135 |
| „ Wash, To make... | 295 | „ Guiana, Duties on | |
| Bleeding, Treatment of | 274 | Tea at | 135 |
| Blocking off Land | 17 | „ New Guinea, Duties | |
| Blood Meal | 246 | on Tea at | 135 |
| Boarding, Cost of Weather | 63 | „ North Borneo, Duties | |
| „ Nails required for | 64 | on Tea at | 135 |
| Boards, Cost of Ceiling | 63 | „ Tea Seasons | 123 |
| „ „ Floor | 63 | „ Westinghouse Water | |
| Boat, Transport by Padia | 92 | Turbine | 51 |
| Boga Medelloa | 236 | Brokerage, Commission, and | |
| Boiler Certificate | 447 | Agency Rates | 435 |
| „ Room, Care of | 448 | Brokers' Inspection Marks, | |
| Boilers, Care of | 49, 448 | London | 124 |
| „ Prevention of Scale | 49 | Bromide of Potassium, Use of | 293 |
| „ Rules relating to | 443 | Bronchitis, Treatment for | 283 |
| Boiling Point | 10 | Bronze, Weight of | 9 |
| Bokera | 29 | Broussonetia Papyr | 28 |
| Bolters | 405 | Brown & Co., Engines | 50, 51 |
| Bombax, Malabaricum | 32 | „ Patent Tea Roller | 68 |
| Bombay, Freight to | 82 | Bruises, Lotions for | 295 |
| Boni | 28, 29 | Bubbles in Sheet Rubber | 170 |
| Bone Meal | 247 | Buckets for Latex | 189 |
| Book, Distribution of Labour | 373 | Budulla | 32 |
| Book-keeping Section | 369 | Buhora | 29 |
| Books, Bank | 370, 383 | Builders' Measurements | 52 |
| „ Cash | 370, 384 | Building Act, London | 53 |
| „ Essential | 870 | „ and Carpentry rates | 76 |
| „ Opening a Set of | 379 | „ Dry rot in a | 35 |
| Borax, Use of | 293 | „ Notes | 52 |
| Boric Acid, Use of | 293 | „ Rubber Factories, | |
| Botryodiplodia Theobromae | 229 | Cost of | 195 |
| Bottle, Glass, Weight of | 9 | Bulgaria, Duties on Tea at | 135 |
| Branch Road Ordinance | 407 | Bulk, Sifting large and small | 106 |
| Branding of Cattle Ordinance | 407 | Bulked Teas, Factory | 126 |
| Brass, Cubic Inches in cwt. | 11 | Bulking of Latex | 190 |
| „ Weight of | 9 | „ of Tea in London | 133 |
| Brazil, Duties on Tea at | 135 | Bulky or heavy articles, Rules | |
| Breaks, Size of | 128 | re Conveyance by Rail of | 80 |
| Breeding and Whelping Dogs | 361 | Bullocks, Nitrogen in Dung | |
| Brick, Paint required for | 37 | from | 241 |
| „ Walls, Foundations | 53 | „ Power of | 45 |
| „ „ Thickness of | 53 | Bulu | 29 |
| „ Work, in Lime, Cost of | 61 | Bungalows, Insurance of | 343 |
| „ „ Safe pressure of | 53 | Burns, Treatment of | 295 |
| Bricklayers' and Builders' | | Buruta | 29 |
| Measurements | 52 | Burying of Tea Prunings | 91, 104 |
| Bricks, Cost of | 52, 92 | Bush, Quantity of Manure to | |
| „ Sun-dried | 52 | apply per | 253 |
| „ Weight of | 9 | Bushel, Equivalent Capacities | |
| Bridelia Moonii | 31 | ties | 11, 12 |
| Bridge, Cost of | 73 | Bushes, Analysis of Prunings | 116 |
| „ Lattice Girder | 75 | „ Treatment of small | 98 |

| | PAGE | | PAGE |
|---------------------------------------|---------|--|----------|
| Cabook , Weight of ... | 9 | Caryota Urens ... | 30 |
| Cacao not to be imported | 438 | Case for Packing Rubber , the | |
| Thefts Prevention ... | | Ideal ... | 172 |
| Ordinance ... | 407 | Cases of Poisoning , How to | |
| Cadjans , Cost of ... | 92 | Act in ... | 285 |
| etc. , Rules <i>re</i> Convey- | | Cash Advances Account ... | 390 |
| ance by Rail of ... | 81 | Cash Book ... | 370, 384 |
| Caffeine , Use of ... | 293 | Cassia Siamea ... | 28 |
| Caicos Islands , Duties | | Cast Iron , Cubic Inches in cwt. 11 | |
| on Tea at ... | 137 | Casuarina ... | 28 |
| Calculating Batta ... | 404 | Cattle , Foot-and-Mouth | |
| Capacity of Hoist- | | Disease in ... | 350 |
| ing Machines ... | 2 | Cattle Manure ... | 241 |
| Speed of Engines ... | 2 | Ordinance , Branding of | 407 |
| Calculations , Hydraulic | 40 | Contagious | |
| Calendar ... | 25 | Diseases 405, 407 | |
| Calicut Tiles , Cost of ... | 65 | Trespass of ... | 407 |
| Calomel , Uses of ... | 294 | Plague or Murrain ... | 351 |
| Calophyllum Bracteatum | 31 | Cedrela Surata ... | 28 |
| Burmanni ... | 29 | Toona ... | 28 |
| Inoph ... | 29 | Ceiling Boards , Cost of | 63 |
| Walkerri ... | 30 | Cloth ... | 63 |
| Cameron , Duty on Tea at | 135 | Nails required for ... | 64 |
| Campbell , L. E., Samples | | Cement ... | 54 |
| prepared by ... | 210 | Concrete ... | 55 |
| Campnosperma Zeylan ... | 34 | Floors, to Stain ... | 57 |
| Canada , Duties on Tea at | 135 | For Driers ... | 57 |
| Cananga Odorata ... | 30 | For Iron ... | 57 |
| Canarium Zeylan ... | 32 | Plaster ... | 57 |
| Canker in Dogs ... | 364 | Plastering to Floors 55, 56 | |
| Canned Goods , Soldering | 60 | Portland ... | 55, 56 |
| Capacity Cubical , of Wood | 27 | to Stand Heat ... | 56 |
| of Cisterns ... | 8 | Weight of ... | 9 |
| C. G. R. Truck ... | 199 | Rust Joint ... | 35 |
| Tanks , Measuring | 8 | Useful Information ... | 55 |
| Cape Colony , Duties on Tea at | 135 | Cements and Mortars , Pro- | |
| Capital Invested in Rubber . | | portions ... | 54 |
| Profit on ... | 174 | Centering Tea ... | 91 |
| Invested in Tea . | | Centiare ... | 8 |
| Profit on ... | 114 | Centigrade , Equivalent of | 10 |
| Carallia , Calycina ... | 31 | Centimetre ... | 7 |
| Integef ... | 28, 29 | Central America , Duties on | |
| Carbolic Acid ... | 35 | Tea at ... | 135 |
| Lotion ... | 295 | Centre , Common to three | |
| Oil ... | 295 | points to find a ... | 21 |
| Carbon Bisulph , to kill Rats | 38 | of Gravity Defined ... | 1, 2 |
| Care of Boilers ... | 49, 448 | Centrifugal Force ... | 1 |
| Horses , Notes on the | 365 | Certificates , Boiler ... | 448 |
| Rubber Machinery ... | 193 | Factory ... | 444 |
| Careya Arborea ... | 30 | False ... | 413 |
| Carpentry rates , Building and | 76 | Ceylon , Anemia of ... | 255 |
| rates , Kalutara ... | 77 | Coconut Cultivation ... | 141 |
| Steam ... | 338 | Coral Lime ... | 58 |
| Cart , Cost of transport by | 92 | Duties on Tea at ... | 135 |
| Cart Road , Cost of ... | 62 | Fertilisers used in ... | 246 |

INDEX

xix

| PAGE | PAGE |
|----------------------------------|---------------------------------------|
| Ceylon, G. R. Coaching Rules 80 | Cistern, Square ... 8 |
| " Railway Rails 66 | Civil Procedure Code, ... 403 |
| " Sawyers' Measurements 27 | Extracts from ... 209 |
| " Tea, Average Compo- | Claims and Objections, London |
| sition of 106 | Sales ... 209 |
| " " How to infuse 125 | " for Rebates, Med. ... 209, 315 |
| " Tea, Jats of ... 97 | Wants Ord. ... 209, 315 |
| " Teas, Indian and 131 | Classification of Railway Goods 82 |
| " Timber ... 29 | Clay, Number of Cubic Feet of, |
| " Truck Capacity 199 | in a Ton ... 7 |
| " Woods ... 30 | " Safe Bearing Power of ... 53 |
| Chatocarpus Castano ... 30 | " Weight of ... 9 |
| Chain, Equivalent Measurement 13 | Cleaning Boilers ... 448 |
| Chaining, Distances in 6 | Cleanliness in Dealing with |
| Chains, Tables of Strength 48 | Latex ... 189 |
| Chalk, Weight of ... 9 | Clearing, Lining a new ... 6 |
| Charcoal, How to make 32 | " Tea, Cost of ... 89 |
| " Weight of ... 33 | Clinometer, A Home made ... 6 |
| Charges, Colombo ... 113 | Cloth, Ceiling, Nails required ... 64 |
| " Medical Wants Ord. 300 | " Cost of Ceiling ... 64 |
| " of producing a Ceylon | Coaching Regulations ... 80 |
| Tea crop, State- | Coagulant ... 190 |
| ment shewing 120 | " Strength of ... 190 |
| " on Tea ... 111, 120 | Coagulation of Rubber ... 190 |
| " to United Kingdom, | Coagulation of Rubber, |
| Postage ... 84 | Hot and Cold ... 216 |
| Check Roll 372, 390, 394 | Coal vs. Wood ... 70 |
| " " Pocket ... 373, 393 | Course Sand, Weight of ... 7 |
| Checks, Internal ... 377 | Cost Advances ... 375 |
| Chemical Fertilisers ... 246 | Cocaine, Uses of ... 294 |
| Chena Ordinance ... 407 | Cocks, Care of Gauge ... 50 |
| Cheques, Writing ... 377 | Coconut ... 31 |
| Chests, Cost of ... 72, 73 | " Beetles ... 148 |
| " Marks on ... 126 | " " Black ... 150 |
| " of Tea, Packing mate- | " " Fungus Para- |
| rials required for 123 | site of ... 151 |
| " Rules, re Conveyance | " " Red ... 149 |
| by Rail of unhooped | " Cost of bringing |
| Tea ... 80 | into bearing ... 147 |
| Chicken-pox, its Treatment 284 | " Cultivation ... 141 |
| Chickrassia Tabularia ... 30 | " Desiccating Machinery 146 |
| Child Birth, Treatment for 295 | " " Mills ... 144 |
| "Child" Defined ... 442 | " Diseases and enemies of 144 |
| Chilli, Duties on Tea at 135 | " Estates, Retains |
| Chills in Horses ... 367 | from ... 148 |
| China Jat Tea ... 97 | " Harvest, Disposal of ... 143 |
| Chloral, Uses of ... 294 | " Harvesting ... 143 |
| Chlorate, Potash, Uses of 294 | " in F. M. S. ... 146 |
| Chloride of Ammonium, Uses 294 | " Land, Estimate for |
| Chloroxylon Swieti ... 29 | Opening ... 146 |
| Chrysophyllum Roxb ... 30 | " Manuring ... 142 |
| Circle, Properties of ... 7, 18 | " Peat, New ... 148 |
| Circumference of a Circle 7, 18 | " " White Fly ... 148 |
| " Sphere ... 18 | " Rules, re Conveyance |
| Cistern, Circular ... 8 | by Rail of desiccated 80 |

| | PAGE | | PAGE |
|------------------------------|------|--------------------------------|----------|
| Coconut Transplanting | 141 | Contagious and Infectious | |
| " Trees, Propping | 143 | Diseases of Cattle | 405 |
| " Weeding | 143 | Contracts, Delivery of Rubber | 207 |
| Cocos Nucifera | 31 | " Shipment of Rubber | 208 |
| Cold Coagulation of Rubber | 218 | " Verbal, Definition | |
| Colds, (Horses) | 367 | of | 408, 420 |
| Colic | 367 | Contractor's Method of Measur- | |
| Collar Pruning, Tea | 96 | ing Earth Work | 17 |
| Collection of Latex | 189 | Convert Metric to English, To | 8 |
| Colombo Charges, Tea | 113 | Conversion of Heat from | |
| " Equivalent value | | Centigrade | 10 |
| of Teas in | 118 | Conveyance of Freight, | |
| " Forwarding Agency, | | C.G.R., Rules re | 80 |
| London and | 83 | Cooly Accounts, Macadam's | |
| " Rubber Sales | 199 | System | 398 |
| " Sales Condi- | | " Average Work of a | 161 |
| tions... | 199 | " Lines, Insurance of | 340 |
| " Tea Sales | 128 | " Register, Macadam's | 396 |
| " Sales Conditions | 129 | Coolies, Indian Ordinance | 407 |
| " Commercial Co. | | Cooling Lotion for Fevers | 295 |
| Engines | 40 | " Lines, Imperative Re- | |
| " Size of Breaks | 128 | construction | 319 |
| Colour of Rubber | 194 | " Sifting Capacity | 106 |
| Columns and Stanchions, | | Copper, Weight of | 9 |
| Foundations, to | 53 | Coral Lime | 58 |
| Commission, Agency and Bro- | | Corrosive Poisoning, How | |
| kerage, Rates | 435 | to Act | 285 |
| Committee, Med. Wants | 302 | Corticum Salmonicolor | 229 |
| Common Ropes, Table of | | Cost of Bricks | 92 |
| Strength | 48 | " Bridges | 73 |
| " Soil, Cubic Feet | | " Bringing Coconuts into | |
| in a Ton | 7 | Bearing | 147 |
| Compo, Paint required for | 36 | " Building Rubber | |
| Composition of Tea Leaves | 106 | Factory | 195 |
| Compound Interest | 24 | " Coal vs. Wood | 70 |
| Computing Areas | 21 | " Constructing a Cart | |
| Interest | 23 | Road | 62 |
| Concerning Vaccination | 334 | " Making one acre of Tea | |
| Concrete, Cement | 55 | Nursery | 105 |
| " Weight of | 9 | " Opening Rubber Lands | 161 |
| " Floors | 56 | Tea Lands | 111 |
| " Plastering | 56 | " Producing, Ceylon Tea | |
| " Safe Pressure on | 53 | Crop statement | |
| " Weight of | 9 | showing | 120 |
| Conditions Col. Rubber Sales | 199 | " Producing Tea per lb. | |
| " Tea Sales | 129 | approximate | 113 |
| " Insurance | 337 | " Rearing Tea Plants | 110 |
| " Lagoon | 131 | " Rubber F. O. B. | 188 |
| " Soil Manuring | 231 | " Seed for Oil | 164 |
| Congeeing Point, Sal Ammon. | 10 | " Running a 2 type | |
| Constipation, How to Treat | 291 | Halley's Motor Lorry | 78 |
| Construction of Cart Road | 62 | " Slaked Lime | 92 |
| Consumption | 284 | " Tea Packages, Average | 123 |
| of Wood Fuel | 69 | " per lb. | 112 |
| | | " Plants | 92 |

| | PAGE | | PAGE |
|--------------------------------|----------|--------------------------------------|--------|
| Cost of Tiles | 92 | Damba | 29, 31 |
| „ Transport by Cart | 92 | Danger of Flies | 289 |
| „ Works per acre | 89 | „ of Fungoid Pests | 104 |
| Cotton Fluff | 193 | Dangerous Petroleum Oil, | |
| Courses, Tool Dressed | | Freight on | 82 |
| Stones in | 55 | Danish Steelyard | 1 |
| Court, To Lay out a Tennis | 20 | „ West India Islands, | |
| Credit, Debit and | 369 | Duties on Tea at | 135 |
| Creosote, Uses of | 234 | Dark Glossy Surface of Rubber | 193 |
| Crepe Rubber, Defects in | 195 | „ Streaks | 192 |
| „ „ Coagulating | 190 | Date Calendar | 25 |
| Crop, Analysis of Ceylon | 234 | Davey Paxman Engines | 50 |
| Crops, Approximate Rubber | 159 | Davies & Co., W. H., | |
| Crotalaria Striata | 236 | Engines | 50, 51 |
| Crushed Fish | 246 | Dawata | 28, 29 |
| Crushing Undecorticated | | Dawul Kurundu | 23, 32 |
| Rubber Seed | 165 | Deaths in Factory, Report | |
| Cryptomeria | 28 | immediately | 446 |
| Cube, Equivalent of Side of | | „ Ordinance, Births & | 407 |
| Inscribed | 18 | „ to be reported by | |
| „ of Metal, Dimensions of | 7 | Superintendent | 406 |
| Cubic Feet in a Ton | 7 | „ Sudden | 403 |
| „ Inches in a cwt. | 11 | Debit and Credit | 369 |
| Cubical Capacity of a Log | 27 | Decimetre | 7 |
| „ Capacity of Planks | 27 | Deeds Ordinance, Registration | |
| Cullenia Excelsa | 32 | of | 407 |
| Cultivated and grass grown | | Deep Wells, Raising Water | |
| land, Moisture in | 239 | from | 46 |
| „ and Uncultivated | | Default, London Rubber | |
| Soils, Moisture in | 232 | Sales | 206 |
| Cultivation and Manuring | 231 | Defects in Crepe Rubber | 192 |
| „ of Tea Land Cost of | 111 | Definitions, Technical | |
| „ „ Coconuts | 141 | Terms and | 456 |
| „ „ Rubber Land, Cost of | 161 | Degrees of Heat | 10 |
| Cups, Best for Latex | 189 | Del | 29 |
| „ Water in | 189 | Delivery Contracts, London | |
| Curative Measures, | | Sales | 207 |
| Anchylostomiasis | 261 | „ of Rubber on String | |
| Cure Dry-rot, To | 35 | Tender | 205 |
| Curing Rubber | 189 | „ Weight of Rubber | 205 |
| „ „ Smoke | 192 | Denmark, Duties on Tea at | 135 |
| Current Account | 374, 387 | Deposits, Tar | 193 |
| Curve, To find Centre | 21 | Depreciation | 376 |
| „ To find Centre Common | | Desiccated Coconuts, Rules <i>re</i> | |
| to Points | 21 | Conveyance by Rail | 80 |
| Cut down, Pruning following a | 100 | „ Milla, Coconut | 144 |
| „ in Pruning, Direction of | 99 | Desiccating Mills, Data <i>re</i> | 144 |
| Cuts, Water on (Rubber) | 189 | „ „ Insurance of | 341 |
| Cutting Across Tea | 95 | Dessert Spoon, Capacity of | 8 |
| „ Down Tea | 96 | D'Esterre's Double Action | |
| Cylindrical Tanks and Cisterns | 8 | Battens | 69 |
| Cyprus, Duties on Tea at | 135 | Destroying Flies | 35 |
| Daily State of Sick on Estate | 279 | Destruction of Rats | 38 |
| „ Task | 100 | Details of Expenditure on | |
| | | Rubber Estate | 160 |

| | PAGE | | PAGE |
|-------------------------------|----------|---------------------------------|----------|
| Detention of Prisoner ... | 403 | Disposal of Coconut Harvest | 143 |
| Determination of Contract | 407 | Distances in Chaining | 6 |
| Diagnosis of Anthrax ... | 349 | „ of Trees, Rubber | 162 |
| „ of Small-pox | 332 | „ Estate | 162 |
| „ of Surra ... | 353 | „ Table shewing size of | |
| Diameter of a Circle ... | 18 | „ Nursery required for | |
| „ „ Pulley ... | 4 | „ Seed at various | 87 |
| „ „ Sphere ... | 18 | Distemper, Native | 58 |
| Diarrhoea, Acute ... | 283 | Distribution of Labour Book | 373 |
| Diesel Engines | 50, 66 | D. M. O., Fees payable to | 306 |
| Diet and Regulations, Medical | | Divide a Line Equally | 23 |
| „ Wants Ordinance ... | 313 | Diyana | 29 |
| Dillenia Indica | 30 | Diyapara | 29 |
| „ Retusa | 29 | Diyatalia | 32 |
| Dimensions of a Cube of Metal | 13 | Dog, How to Treat Bite of Mad | 292 |
| Diospyros | 30 | Dogs and their Management | 359 |
| „ Ebenum | 30 | „ and their Treatment, | |
| „ Quaesita | 30 | „ Diseases of | 359 |
| Dipterocarpus, Glandulosus | 29 | „ Prohibitions re import | 441 |
| „ Hiapi, etc. | 29 | „ Rabies in | 354 |
| „ Zeylanica | 30 | Domba | 29 |
| Direction of Cut in pruning | 99 | Domestic Servants Ordinance | 407 |
| Directions for Vaccination | 327 | Dominica, Duties on Tea at | 135 |
| Discoloration, Mottling Spots | | Dominican Republic, Duties | |
| „ and ... | 192 | „ on Tea at | 135 |
| Disease, Hookworm | 255 | Doon | 33 |
| „ How to avoid | 288 | Doona Congestiflora | 32 |
| „ in prepared Rubber. | | „ Macro. etc. | 29 |
| „ Fungoid spot | 184 | „ (spp.) | 29 |
| „ Pink | 229 | „ Trapeziifolia | 31 |
| „ Pod | 228 | Doors, Cost of | 65 |
| „ Want of vitality pre- | | Dorona | 29 |
| „ disposing | 100 | Double Action Battens, Cost of | 69 |
| Diseases and Enemies of Coco- | | „ Entry, Advantages of | 369 |
| „ nuts | 144 | „ „ in Bookkeeping | 369 |
| „ Equine, Regulations re | 440 | Drachms, to Measure | 8 |
| „ Notifiable | 284, 317 | Draft, Definition of | 127 |
| „ of animals | 349 | Drainage of Tea Estates, | |
| „ of Cattle Ordinance | 405 | „ Cost of | 90, 103 |
| „ of Dogs and their | | „ Rubber Estates, Cost | |
| „ Treatment | 359 | „ of | 153, 161 |
| „ of Hevea Brasiliensis, | | Drains, Cost of | 75, 93 |
| „ Fungoid | 223 | Draughtsmen and Pattern | |
| „ of Plants Ordinance | 437 | „ Makers, Hints for | 18 |
| „ Ordinance, Preven- | | Dressed Stones in Courses, Tool | 55 |
| „ tion of | 316, 320 | Driers, Cement for (see Dryers) | 58 |
| „ Stem | 226 | „ Chimneys, Height of | 145 |
| „ Treatment of | 225 | Drink, Food and | 291 |
| Disinfection, Rules re | 270 | Drowning, How to Act | 277 |
| Dislocations, Treatment | 273 | Drugs Act, Sale of Food | 132 |
| Dismissal of Labourer | 408 | „ for Estate Use, Useful | 293 |
| Dispensaries, Issue of Drugs | | „ Supply of | 308 |
| „ from Govt. | 283 | Dry Measures (Ceylon Land) | 11 |
| „ Information for | | „ Rot, to Cure | 36 |
| „ Estate | 266 | „ Rubble, Cost of | 61 |

| | PAGE | | PAGE |
|---------------------------------|----------------|-------------------------------------|----------|
| Dry Tea Seed, to ... | 36 | Empties, Rules <i>re</i> Conveyance | |
| " Zone Woods ... | 33 | by Rail of ... | 81 |
| Dryers, Cost of ... | 69 | Enabling Portland Cement to | |
| Drying Tea ... | 124 | stand Heat ... | 56 |
| Dubbing ... | 35 | Enemies of Coconuts ... | 144 |
| Duin, Dutch Measure | 12 | Engine Room, Care of | 448 |
| Dun ... | 29 | " Steam ... | 51 |
| Dung from Bullocks, Nitro- | | " Suction Gas ... | 51 |
| gen in .. | 241 | Engines, Calculate Speed of | 2 |
| Dunstan, Prof. Wyndham R. | 210 | " Liquid Fuel ... | 50 |
| Duration of Rabies ... | 355 | English Inland Parcel Post | 84 |
| Dutch Clinker Bricks ... | 53 | Entry in Bookkeeping, Double | 369 |
| " Measurements ... | 12 | Equal Divisions, To divide a | |
| Duty Imposed by Cess, Tea | 113 | line into ... | 23 |
| " on Russian Tea ... | 128 | Equilateral Triangle, Equiva- | |
| " on Tea Ordinance | 407 | lent of .. | 18 |
| Duties of Hospital Visitors | 306 | " Triangular system | 251 |
| " of Medical Officers | 298 | Equilibrium ... | 1 |
| " of Supdts Med. Wards | | Equine Diseases ... | 440 |
| " Ordinance | 299 | Equivalent Value of Teas | 118 |
| " on Tea all over the | | Erythrina lithosperma (Dadap) | 236 |
| " World ... | 135 | Essay on Tea pruning, Prize | 93 |
| " on Rubber, Export | 187 | Essential Books ... | 370 |
| Dynamo, Care of ... | 454 | Estate Bookkeeping ... | 369 |
| Dysentery in Dogs ... | 363 | " Electricity, Cost of | |
| " Treatment for | 277 | " Installing ... | 451 |
| Ear-ache , Treatment for | 295 | " Hospitals, Rules for | 308 |
| Early Stages, Diagnosis of | | " Labourers, Useful | |
| Small-pox in ... | 332 | " Medical Treatment | 277 |
| Earth, Cubic Feet in a Ton | 7 | " of 400 acres, Cost of pro- | |
| " Weight of ... | 9 | " ducing Tea on an | 113 |
| Earthwork, How to | | " Use, Useful Drugs for | 293 |
| Measure | 14, 15, 16, 17 | Estimate for Opening Coconut | |
| Ebony ... | 30 | Land ... | 146 |
| " Weight of ... | 9 | Et-amba ... | 28, 32 |
| Economic Tea Roller ... | 68 | Ether, Boiling Point ... | 10 |
| Ecuador, Duties on Tea at | 135 | Ergot, Liquid Extract of, Its | |
| Eczenia in Dogs ... | 361 | Uses ... | 295 |
| Edges, Thickened ... | 193 | Eruption in Small-pox ... | 332 |
| Effective Power, Water Wheels | 47 | Eucalyptus ... | 28 |
| Egret not to be Exported | 436 | Eugenia Neesiana ... | 31 |
| Egypt, Duties on Tea at | 135 | " Operculata ... | 29 |
| Ehali ... | 33 | " (spp) ... | 29 |
| Elæcarpus Serratus ... | 31 | " Sylv., etc. ... | 29 |
| Elæodendron ... | 31 | Exemption from Vaccination | 326 |
| Electric Light, Data <i>re</i> | 451 | Expenditure Account | 375, 391 |
| " " Installation, | | " on Rubber, Details | |
| " Cost of | 451 | " of ... | 160 |
| " Wires to be Insu- | | Export Duty on Tea Ordinance | 407 |
| " lated ... | 442 | " Duties on Rubber | 187 |
| Elevations, Trees to plant | | Exportation of birds forbidden | 436 |
| various ... | 28 | Exposure, Sun ... | 292 |
| Ellipse, Area of ... | 18 | Extract of Ergot, Liquid | 295 |
| Elongation ... | 212 | Extracting Trial Balance | 392 |
| | | Extracts from Memo by Messrs. | |
| | | Figgis & Co. 185 | |

| | PAGE | | PAGE |
|--------------------------------|--------|---------------------------------|--------|
| Extracts from Memo by Messrs. | | Finding Diameter of a Pulley | 4 |
| " " by Messrs. | | " Width of belting | |
| Lewis & Peat | 185 | required ... | 39 |
| " from the Rules of the | | Finland, Duties on Tea at | 135 |
| Conveyance of Goods | | Fire Insurance Rubber Sales | 209 |
| on Ceylon Government | | Fireproof Buildings, Definition | |
| Railway ... | 80 | of ... | 346 |
| Eyes, Treatment of Sore | 295 | " Cement, Cost of | 56 |
| Faberi. "Canker," | | Firewood cutting rates | |
| Phytophthora ... | 226 | (Kalutara) ... | 77 |
| Factories, Cost of Tea | 72 | Fish Crushed ... | 246 |
| " Wood fuel for Tea | 69 | " Guano ... | 246 |
| " for Rubber .. | 195 | Fits, Treatment for ... | 275 |
| " Rules relating to | 442 | Fixtures ... | 449 |
| Factory Bulked Teas | 126 | Flies, Danger of ... | 289 |
| " Electric Installation | 451 | " To Destroy ... | 35 |
| " In the Rubber | 190 | Floating Policies, Insurance | 338 |
| " Insurance of a | 339 | Flooring, Nails required for | 164 |
| " Sundries, Tea | 92 | Floors, Concrete ... | 56 |
| " Windows, Cost of | 64 | " Cost of ... | 61, 75 |
| Facts Concerning Vaccination | 334 | " Stain ... | 58 |
| Fahrenheit, Equivalent of | 10 | " to Stain Cement | 57 |
| Fall in the S.W. Monsoon, Leaf | 228 | Flower of Sulphur ... | 35 |
| False Certificates ... | 413 | Flowing in a Stream, Measuring | |
| Fans ... | 121 | Water ... | 42 |
| Farmyard Manures, Analyses of | 244 | Fluff, Cotton ... | 192 |
| Fathom, Equivalent Measures | 13 | Fly Beetle Pest, White | 148 |
| Feeding Horses ... | 365 | Flys, To Destroy ... | 35 |
| F. M. S. Coconuts, in ... | 146 | Follicular Mange ... | 360 |
| Fees payable to D. M. O. | 306 | Fomes Legnosus ... | 223 |
| " " to M.O.'s in the | | Fomes Semitostus ... | 223 |
| dept. of Govt. | 316 | Food and Drink, What to avoid | 291 |
| Felling and Clearing Tea, Cost | | " " Drug Act, Sale of | 132 |
| of ... | 89 | Foot and Mouth Disease in | |
| Felt, Roofing ... | 60 | Cattle ... | 350 |
| Fencing Gearing and Belting | | Foot, Equivalent Measurements | 13 |
| in Factory ... | 442 | " Gallons in a ... | 8 |
| Fertilisers, Chemical ... | 246 | " Pound Defined ... | 39 |
| " Commonly used in | | Force, Centrifugal ... | 1 |
| Ceylon ... | 246 | " Defined ... | 2 |
| " Ordinance ... | 407 | " Motion and ... | 2 |
| Fever, Cooling Lotion for | 293 | " Unit of ... | 2 |
| Few Prescriptions, A ... | 295 | Foreign Body in Nose ... | 292 |
| Ficus Calosa ... | 32 | " Parcel Agency Rates | 83 |
| Fig ... | 254 | " Trees ... | 28 |
| Figgis & Co., Memo by | 185 | Forest Ordinance ... | 407 |
| Fiji, Duties on Tea at ... | 135 | Form of Tender ... | 203 |
| Filicium Decipiens ... | 28, 31 | Formalin ... | 35 |
| Filling in Tea ... | 89 | Forms of Rabies ... | 355 |
| Financial Provisions, Med. | | Formula for Measuring Rainfall | 34 |
| Wants Ordinance ... | 303 | Forwarding Agency, London | |
| Finding Area on a Plan | 17 | and Colombo ... | 83 |
| " Centre common to | | Foundations of Brick Walls | 53 |
| three points | 21 | " to Columns and | |
| | | Stanchions | 54 |

I N D E X

xxv

| | PAGE | | PAGE |
|--------------------------------|------|----------------------------------|------|
| Fractures, Treatment for | 276 | General Conditions, London | |
| Frames, Cost of Window and | | Rubber Sales | 209 |
| Door ... | 66 | Information ... | 1 |
| France, Duties on Tea at | 135 | Notes on Manuring | 249 |
| Freights for Bombay ... | 83 | Remarks on | |
| Freight on Manure, Rail | 254 | Bookkeeping | 377 |
| on Tea, Ocean... | 138 | Germinating Tea Seed | 86 |
| Steamer ... | 82 | Giant Tea Roller, Jackson's | |
| French Oceania, Duties on | | Little ... | 68 |
| Tea at ... | 135 | Gibraltar, Duties on Tea at | 136 |
| Friction ... | 1 | Gikiyanakande, Vulcanisation | |
| Fruit, Passion ... | 254 | tests on Samples of Rubber | |
| Procedure, Fumigating | 439 | prepared at | 214 |
| Fuel, Liquid, Cost of ... | 66 | Girder Bridges, Lattice | 75 |
| Consumption of Wood | 69 | Glass Tiles, Cost of ... | 65 |
| Engine, Diesel Liquid | 66 | Glass, Weight of Bottle | 9 |
| for Tea Factories, Wood | 69 | Glochidion Zeylan ... | 30 |
| for Tea Manufacture | 91 | Glossy Surface of Rubber, Dark | 193 |
| Fulcrum ... | 1 | Glycerine, Uses of | 294 |
| Fumigated, All Imported Plants | | Godapara ... | 29 |
| to be ... | 438 | Gold Coast, Duties on Tea at | 136 |
| Fungoid Disease of Hevea | | Gold, Weight of ... | 9 |
| Brasiliensis | 223 | Gomphia Augusti ... | 29 |
| Pests, Danger of | 105 | Gona ... | 32 |
| Spot Disease .. | 184 | Goods, Classification of Railway | 82 |
| Fungus Parasite of Coconut | | Conveyed by Special | |
| Beetle ... | 151 | Arrangement .. | 81 |
| Pest Ordinance | 437 | of the sixth class, Rules | |
| Furlong, Equivalent Measure- | | re Conveyance by | |
| ments | 13 | Rail of ... | 81 |
| Furnace Work, Cement for | 56 | Rules re Conveyance of | |
| Furniture, Poochies in Up- | | C. G. R. ... | 80 |
| holstered | 38 | Goraka ... | 29 |
| Gadumba ... | 29 | Government Agent and | |
| Gallis ... | 33 | Factories ... | 443 |
| Gallon of Tar will Cover | 37 | Dispensaries, etc., | |
| Gallons ... | 8 | Issue of Drugs | 263 |
| in one Barrel ... | 8 | Government Railway, Rules re | |
| per Foot ... | 8 | Conveyance of Goods | 80 |
| Hogshend ... | 8 | Government Dispensing, Rates | |
| Galmora ... | 29 | for ... | 307 |
| Galvanized Iron Roofs | 35 | Grading and Quality of | |
| Gambia, Duties on Tea at | 135 | Rubber ... | 187 |
| Gammalu ... | 29 | Grading and Sorting of | |
| Ganmi ... | 29 | Rubber ... | 194 |
| Garcinia Cambogia ... | 29 | Grammes ... | 8 |
| Echinocarpa ... | 30 | Granite, Weight of ... | 9 |
| Terpuophyllia | 30 | Grapes... .. | 254 |
| Gas Engines, Suction ... | 51 | Grass-grown land, Moisture | |
| Gauges, and Cocks, Care of | 50 | in ... | 239 |
| Gearing and Belting to be | | Gravel, Cubic Feet in a Ton | 7 |
| Fenced ... | 442 | Safe Bearing Power of | 53 |
| Gedumba ... | 28 | Gravity defined, Centre of | 1, 2 |
| | | Greece, Duties on Tea at | 136 |
| | | Green Leaf Manufacture | 107 |

| | PAGE | | PAGE |
|---------------------------------|----------|---------------------------------|--------|
| Green Leaf Sifters ... | 121 | Height for Pruning Tea ... | 98 |
| „ „ Sifting ... | 121 | Heights to which pumps may | |
| „ „ Value of ... | 116 | be worked | 45 |
| „ Tea Manufacture ... | 107 | Hemicyclia Sepiaria ... | 31 |
| „ Manuring ... | 235 | Herring-bone Tapping, Half | 165 |
| Grenada, Duties on Tea at | 136 | Hessian Tats ... | 109 |
| Grevillea Robusta ... | 28 | Hevea Brasiliensis, Fungoid | |
| Grey Wash for Walls, Stone | 37 | Diseases of ... | 223 |
| Grooming of Dogs ... | 359 | „ Rubber, Cost of bringing | |
| Gross Weight of Tea ... | 126 | into bearing ... | 153 |
| Growers' Association, Rubber | 189 | „ Rubber Seed for Oil | 164 |
| Guano, Fish ... | 246 | Hill sp. ... | 30 |
| „ Peruvian ... | 246 | Hingul ... | 30 |
| Guarantee, Rubber Inferior to | 208 | Hints for Draughtsmen and | |
| „ Solvency, Rubber | | Pattern Makers | 18 |
| Sales | 209 | „ Legal ... | 403 |
| Guardian, Vaccination | | Hoare & Co.'s Engines | 50 |
| Offences ... | 322 | Hogshead, Gallons in one | 8 |
| Guidance of Estate Proprietors, | | Hoisting Machine, Capacity of | 8 |
| Rules for ... | 309 | Holing Tea, Cost of ... | 39 |
| Gunshot Wounds ... | 293 | Holland, Duties on Tea at | 136 |
| Gunther Turbine ... | 51 | Homalium Zeylan ... | 30 |
| Gurukina ... | 29 | Homederia ... | 30 |
| Gypsum ... | 248 | Hondapara ... | 30 |
| Hadawaka ... | 30 | Honduras, Duties on Tea at | 136 |
| Hæmorrhage ... | 274 | Hookworm Disease ... | 255 |
| Hal ... | 28 | Hora ... | 30 |
| Half Herring-bone Tapping | 165 | Hornbill not to be Exported | 436 |
| Halmendora ... | 29 | Hornaby and Hornsby-Akroyd | |
| Halmilla ... | 28, 29 | Engines | 50 |
| Hampalanda ... | 29 | Horse Disease Ordinance | 440 |
| Handy Weights and Measures | 8 | „ Power Defined ... | 39, 45 |
| Hapu ... | 30 | „ „ Strength of | 39 |
| Harbour Dues, Colombo | 113 | „ „ of Water | |
| Hard and Soft Water ... | 34 | Wheels 42, 47, 48 | |
| Harvest of Coconuts, Disposal | | „ „ Width of Belting | |
| of ... | 143 | for ... | 39 |
| Harvesting Coconuts ... | 143 | Horses, Notes on the Care of | 365 |
| Halley's Motor Lorry for 1 | | Hospitals, Issue of Drugs from | 263 |
| week on the Deltota Road, | | Hospital Visitors, Powers and | |
| Galaha, Cost of running a | | Duties ... | 308 |
| 2 type.. | 78 | Hot Air Fans ... | 121 |
| Hazeline, Uses of ... | 294 | Hot Coagulation of Rubber | 216 |
| Headache, Treatment for | 295 | House Disinfection, Notes on | 271 |
| Headmen, Police and ... | 297, 405 | How to act in Cases of | |
| Health, Simple Rules of | 286 | Poisoning | 265 |
| Heat and Stickiness ... | 192 | „ Infuse Ceylon Tea | 125 |
| „ Degrees of ... | 10 | „ Lay out a Tennis Court | 20 |
| Heavy Articles,* Rules re | | „ Make Charcoal | 32 |
| Conveyance by Rail of | | Hulan-hik ... | 30 |
| Bulky and | 80 | Hunu-kirilla ... | 30 |
| „ Colds and Chills in | | Hyacinth not to be Imported. | |
| Horses ... | 367 | Water ... | 439 |
| Hectare ... | 8 | Hydrargyri Perchloride, Liquid, | |
| | | Uses of ... | 295 |

INDEX

xxvii

| | PAGE | | PAGE |
|---------------------------------|----------|--------------------------------|----------|
| Hydraulic Calculations | 40 | Insulation of Electric Wires | 442 |
| " Ram | 40 | Insurance | 337 |
| Hydrochloric Acid, for removing | | " Rubber Sales, Fire | 209 |
| old Putty | 37 | Interest, Computing | 23 |
| Hymenocbete Noxia | 224 | " Simple and Compound | 24 |
| Hypobrunnea, Poria | 224 | " Table | 24 |
| Hypotenuse to Base, Table | | Internal Checks | 377 |
| for Reducing | 7 | Intermediate Zone Woods | 33 |
| Ice , Melting Point of | 10 | Intervals, Increased Yield of | |
| Ideal Case for Rubber... | 172 | Rubber at | 166 |
| Ignorance of Law no Defence | 403 | Inventors' Ordinance | 407 |
| Ilex Wightii | 32 | Iodide of Potassium, Uses of | 294 |
| Imperial Institute, Summary of | | Iodoform, Uses of | 294 |
| Vulcanisation Tests at the | 214 | Iriya | 32 |
| Impersonal Accounts | 370 | Iron, Cast, Cubic Inches | |
| In the Rubber Factory | 190 | in Cwt. | 11 |
| Inches | 8, 13 | " Cement for | 57 |
| " Cubic in Cwt. | 11 | " Cubic Inches in Cwt. | 11 |
| Increase of Insurance | 338 | " In Stone, Soldering | 60 |
| Increased Yield at Long | | " Paint, Oxide of | 37 |
| Intervals, Rubber | 166 | " Paint required for | 37 |
| Incubative period, Rabbits | 355 | " Roofs, Leaks in | 35 |
| India, Duties on Tea at | 136 | " " Nails required for | 64 |
| Indian and Ceylon Teas | 131 | " Weight of | 9 |
| " Coolies' Ordinance | 407 | " Wood | 31 |
| Infected Room, To Disinfect | 271 | " Weight of | 9 |
| Infectious Diseases, Notifiable | 405 | " Wrought, Cubic Inches | |
| Inferior to Guarantee, Rubber | 208 | in Cwt. | 11 |
| Information, General | 1 | Isolation in Certain Diseases | 271 |
| " Medical | 255 | Isonandra Lanceolata | 31 |
| Intuse Ceylon Tea, How to | 125 | Issue of Medicines to Superin- | |
| Injury in Factory, Report | | tendents, Regulations for | 263 |
| at once | 446 | Itch, Treatment for | 280 |
| Inland Parcel Post, English | 84 | Jackson's Tea Rollers | 68 |
| Inoculation, Preventive | 353 | Jakwood | 28, 30 |
| Inquirers, Powers of | 403 | " Weight of | 9 |
| Inscribed Cube, Size of | 18 | Jamaica, Duties on Tea at | 136 |
| Insect Pest Ordinance | 407, 437 | Japan, Duties on Tea at | 136 |
| Inspection Marks, London | | Jarrah, Cost of | 64 |
| Brokers | 124 | " Weight of | 9 |
| " of Tea in London | 133 | Jats of Ceylon Tea | 97 |
| Inspectors, Factory | 444 | Java, Duties on Tea at | 136 |
| Installing Electric Light, | | Joint Cement | 35 |
| Cost of | 451 | Journal, The | 370, 385 |
| Instant Dismissal of Labourer | 408 | Journalising | 370 |
| Institute, Summary of | | Journymen Artificers, | |
| Vulcanisation Tests at the | | Ordinance relating to | 408 |
| Imperial | 214 | Judicial Works, M. O's Fees | 316 |
| Instructions for guidance | | Jurors and Witnesses | 404 |
| of Supdts. | 266 | Kabalmara | 28 |
| " for Police and | | Kadul | 30 |
| Headmen | 297 | Kuhata | 30 |
| Instruments not Supplied | | Kalumederia | 30 |
| by Government, Surgical | 268 | | |

| | PAGE | | PAGE |
|--------------------------------|--------|--------------------------------|----------|
| Kalutara Cane Baskets | 113 | Land, Cost of Opening Coconut | 146 |
| " Masonry Rates | 75 | " " " Tea | 111 |
| Kaluwara | 30 | " Cultivation of Rubber | 161 |
| Kampotta | 33 | " " " of Tea | 111 |
| Kandyan Land Measures | 12 | " Measurements | 5, 17 |
| Kangany's Duty, Medical Wants | | " Measures, Ceylon | 11 |
| Ordinance | 300 | " Moisture in Cultivated | |
| Karawn | 30 | and Grass grown | 239 |
| Katuboda | 32 | " Mud | 12 |
| Katukanda | 33 | " Registration Ordinance | 407 |
| Katuimbul | 32 | Landing Tea in London | 133 |
| Ked Toon | 28 | Lands Ordinance, Unoccupied | 407 |
| Kegalle District Land Measures | 12 | Large Bulk Sifting | 106 |
| Keiller, P. A., Remarks by | 231 | Lasainthera Apicalis | 32 |
| Kekuna | 32 | Latex, Bulking of | 190 |
| K. V. Estate, Cost of Liquid | | Collection | 189 |
| Fuel on | 67 | Preliminary Treatment | 190 |
| Ketakela | 33 | Reception of | 190 |
| Khata | 30 | Straining of | 190 |
| Kiauchou, Duties on Tea at | 136 | Transport of | 189 |
| Killing Knots in Wood | 36 | Treatment of | 189 |
| Kilogrammes | 8 | Lattice Girder Bridges | 75 |
| Kilometre | 7 | Laudanum, How to procure | 263 |
| Kina | 30 | Law of Evidence Ordinance | 407 |
| Kingfisher not to be Exported | 436 | Laws of Motion | 1 |
| Kirikon | 30 | Lawulu | 30 |
| Kital | 30 | Lay a Right Angle, To | 19 |
| Knives for Pruning | 99 | " a Tennis Court | 20 |
| Knots in Wood, To kill | 36 | Lb., Cost of Tea per | 112 |
| Kohomba | 30 | " Cost of Producing Tea per | 113 |
| Kokatiya | 30 | Lbs., Metric Equivalents | 8 |
| Kokun | 32 | Leaf, Cost of | 123 |
| Kokuna Zeylan. | 32 | " Cubic inches in cwt. | 11 |
| Kon | 30 | " Weight of | 9 |
| Korea, Duties on Tea at | 136 | Leaf fall in the S.W. Monsoon | 228 |
| Kos | 30 | " Plucking Tea | 117 |
| Kududowla | 32 | " Sifters, Green | 121 |
| Kumbuk | 30 | " Sifting, Green | 121 |
| Kurrimia Zeylan. | 31 | " Transport | 120 |
| Kurani, Equivalent Measure | | " Value of Green Tea | 116 |
| ment of | 11, 12 | " Withering | 122 |
| Labour | | Leaks in Zinc or Iron Roofs | 35 |
| Distribution of, Book | 373 | Ledger, The | 372, 387 |
| " on Rubber Estates | 181 | Leech Bites and their Treat- | |
| " Paying off | 408 | ment | 293 |
| Labourers, Issue of Drugs for | | Lefel's Weir Tables | 46 |
| use of | 263 | Legal Chapter | 403 |
| Ordinance | 297 | " Hints | 403 |
| Treatment, Medical | 277 | " Maxims | 403 |
| Wages, How pay- | | Leguminous Plants, Nitrogen in | 235 |
| able | 408 | Lemon | 254 |
| Lagerstrœmia Flores | 31 | Lewis and Peats Remarks | 185 |
| Lagos, Duties on Tea at | 136 | Lichen, Moss and | 99 |
| Laha, Equivalent Capacities | 11 | Life not to be Jeopardised | 443 |
| Land, An acre of | 11 | Light, Electric, Data re | 451 |

| PAGE | PAGE |
|---------------------------------------|-------------------------------------|
| Lignosus, Fomes ... 223 | Longitude reduced to Time ... 34 |
| Lime as Manure ... 239 | " Time reduced to ... 34 |
| Brickwork in ... 61 | Loose Articles, Rules re Convey- |
| Coral ... 58 | ance by Rail of Small or 80 |
| Cost of ... 92 | " Earth in a Ton ... 7 |
| Nitrate of ... 247 | Loss Statement, Profit and ... 369 |
| Plaster ... 57 | Lotion, Carbolic ... 295 |
| Water, To Make... 295 | Cooling ... 295 |
| Lining ... 239 | Lotions for Sprains and Bruises 295 |
| Line, To divide a ... 23 | Low Elevation trees ... 28 |
| Lines, Tea ... 92 | Louvre Boarding, Nails for ... 64 |
| Lining a New Clearing ... 6 | Lubrication of Rubber Machi- |
| Tea Land ... 89 | nery ... 193 |
| Link, Equivalent measurement 13 | Lunamidilla ... 28, 30, 32 |
| Links, Square, Reduced to acres 18 | Macadam's Account System 398 |
| Liquid Extract of Ergot ... 294 | Cooly Register ... 396 |
| Fuel ... 66 | Machine, Determining Speed of 4 |
| " Cost of ... 66 | " Pulley required to ... 4 |
| " Engines Diesel 50, 66 | " Rubber ... 193 |
| " Hydrargyri Perchloride 294 | Machinery, Coconut Desiccat- |
| Liquor of Subacetate of Lead ... 294 | ing ... 146 |
| List of Ordinances ... 407 | " Defined ... 442 |
| Litres ... 8 | " Fenced, To be ... 442 |
| Litsea Chinaea ... 29 | " Lubrication of ... 193 |
| Sebifera ... 28 | " Notes ... 1 |
| Zeylanica ... 28, 32 | " Ordinance ... 407 |
| Litters, Absorptive power of ... 242 | " Rubber, Care of ... 193 |
| Little Giant Tea Roller, ... 68 | Machitus Machra ... 32 |
| Jackson's ... 30 | Mad Dog, How to Treat Bite 292 |
| Liyan ... 166 | Madatiya ... 28, 30 |
| Lock, Dr. ... 166 | Madol ... 30 |
| London and Colombo | Madras Thorn ... 28 |
| Forwarding Agency 83 | Magistrate, Unofficial Police 405 |
| " Brokers' Marks ... 124 | Magnifera Indica ... 29 |
| " Building Act ... 53 | " Zeylan ... 28, 32 |
| " Bulking of Tea in ... 133 | Maha-badulla ... 32 |
| " Conditions of Sales ... 131 | Mahogany Stain ... 59 |
| " Inspection of Tea in ... 133 | Main Shafting, Speed of ... 5 |
| " Landing Tea in ... 133 | Making Charcoal ... 32 |
| " Market, Tea sifting ... 106 | " Crepe ... 190 |
| " for the ... 106 | " one acre Tea Nursery |
| " Prices, Equivalent value ... 118 | and upkeep for nine |
| " of Tea in Colombo to 118 | months, Cost of ... 105 |
| " Rubber Sales ... 201 | " Sheet Rubber... 191 |
| " " Conditions 209 | Malaboda ... 32 |
| " Sales, Date of ... 83 | Malarial Fever ... 280 |
| " Sampling of Tea in ... 133 | Malta, Duties on Tea at ... 136 |
| " Selling of Tea in ... 133 | Manumitis ... 334 |
| " Stock Brick ... 52 | Management of Dogs ... 359 |
| " Tea Sales Conditions 131 | Man, Power of a Strong ... 39 |
| Long Intervals, Increased Yield | Mangalore Tiles ... 60 |
| of Rubber at ... 166 | Mange in Dogs ... 360 |
| Measure ... 13 | Mango ... 29, 254 |
| Term Insurances... 338 | |

| | PAGE | | PAGE |
|-------------------------------|---------|-------------------------------|--------|
| Manufacture of Green Tea | 107 | Measuring Rainfall | 34 |
| " of Tea, Cost of | 91 | " Sawyers | 27 |
| Manure, Cattle | 241 | " Superficial | 5 |
| " Rail-freight on | 254 | " Timber | 27 |
| " to apply per Tea Bush, | | Measurement of Water flowing | |
| Quantity of | 253 | in Stream | 42 |
| Manures, Analyses of | | Measurements, Bricklayers and | |
| Farmyard | 244 | Builders | 52 |
| Ordinance | 407 | " for opening up | |
| Manuring Chapter | 231 | New Land | 5 |
| Coconuts | 142 | Measures, Anchylostomiasis, | |
| Cost of | 91 | Curative | 261 |
| Green | 235 | Anchylostomiasis, | |
| Notes on | 249 | Preventive | 259 |
| Ordinance | 407 | Ceylon Land | 11 |
| Tea | 91, 102 | Handy Weights and | 8 |
| Mara | 30 | Mechanics, Principles in | 1 |
| Marble (Carara), Weight of | 9 | Medical Information | 255 |
| Marking Rubber Cases | 186 | Instructions to Superin- | |
| Marks, London Brokers' | | tendents | 263 |
| Inspection | 124 | Officer, Definition of | 297 |
| " on Chests | 126 | Officers, Duties | 298 |
| " used for Tea | 124 | Ordinance | 297 |
| Marriages Ordinance | 407 | " Rules | 306 |
| Mason | 54 | " Wants Committee | 302 |
| Masonry, Cost of | 54, 61 | " Ordinance | 407 |
| Cost of Tool Dressed | 61 | Medicine for Estate, Rules | 263 |
| Data | 61 | Melia Dubia | 28, 32 |
| Dry Rubble | 61 | Melting point of Ice | 10 |
| Rates | 75 | Memoranda by Messrs. Figgis | |
| Maes, Defined | 2 | & Co., Extracts | |
| Mastixia Tetra | 32 | from | 185 |
| Material for Tea, Packing | 123 | " by Messrs. Lewis | |
| Materials, Weights of... | 9 | & Peat, Extracts | |
| Maund, Equivalent of | 105 | from | 185 |
| Mauritius, Duties on Tea at | 136 | " Rainfall | 34 |
| Maxims, Book-keeping | 377 | " Useful | 23 |
| Legal | 403 | Memorandum as to Landing, | |
| Maximum Task for Cooly | 412 | etc., Teas | 133 |
| Meal, Blood | 246 | Mendora | 30 |
| Bone | 247 | Meaua Ferrea | 31 |
| Measles and its Treatment | 284 | Thwaitesii | 29 |
| Measure, Dry | 11 | Metal, Cost of Road | 62 |
| Earth-work, How to | 14 | Dimensions of a Cube | 13 |
| for Remedying Coco- | | " Measuring | 13 |
| nut Pest | 151 | Metallic Roller, New | 68 |
| Land | 11 | Method of Measuring Earth- | |
| Long | 13 | work, Contractor's | 17 |
| Metal | 13 | Metre | 7 |
| Solid | 7 | Metres in a Yard | 7 |
| Square | 13 | Metric System | 7 |
| Wet | 12 | Mexico, Duties on Tea at | 138 |
| Measuring Capacity of Cistern | 8 | Mi | 30 |
| " " Tanks | 8 | Mica, Weight of | 9 |
| " Earth Work | 14, 15 | Michelia Champaca | 28, 31 |

I N D E X

xxxi

| | PAGE | | PAGE |
|--|----------|--|------|
| Michelia Nilagerica ... | 31 | Mulching ... | 237 |
| Michie's Wire Shoot Runners ... | 71 | Mule, Power of ... | 39 |
| Mile, Equivalent Measurements ... | 13 | Muna Mal ... | 31 |
| " Mill-Gearing ' Defined ... | 442 | Murray ... | 351 |
| Milla ... | 30 | Muruta ... | 31 |
| Millimetre ... | 7 | Myristica Horsfieldia ... | 32 |
| Mills, Cost of ... | 145 | " Iriya ... | 32 |
| " Data re Desiccating ... | 144 | " Laurifolia ... | 32 |
| Mimusops Elengi ... | 31 | Na ... | 31 |
| " Hexandra ... | 31 | Na-imbul ... | 31 |
| Mines and Machinery Ordinance ... | 407 | Na-mendora ... | 31 |
| Minimum Insurance Rates ... | 339, 341 | Nails, Cost of ... | 64 |
| " Thickness of Brick Walls ... | 53 | " Number required ... | 64 |
| Minute by the Governor ... | 404 | Names of Birds not to be Exported ... | 436 |
| Miscellaneous Medical information ... | 305 | Natal, Duties on Tea at ... | 136 |
| Mixing Acid and Latex ... | 191 | National Engines ... | 50 |
| Mixtures of Air, Saturated ... | 121 | Native Distemper ... | 58 |
| Moisture in Cultivated and uncultivated Soils ... | 232 | " Tiles ... | 60 |
| " in Cultivated and grass grown land ... | 239 | " Trees ... | 28 |
| Molpedda ... | 31 | Nedun ... | 31 |
| Momentum Defined ... | 2 | Nephelium Longana ... | 31 |
| Monthly Report ... | 376 | Neralu ... | 31 |
| Montserrat, Duties on Tea at ... | 136 | Net, Definition of ... | 127 |
| Mora ... | 29, 31 | Netau ... | 32 |
| Morgan, Remarks by Sydney ... | 167 | Neuralgia ... | 295 |
| Morgen, Dutch Measure ... | 12 | New Coconut Pest ... | 148 |
| Morocco, Duties on Tea at ... | 136 | " Clearing, Lining a ... | 6 |
| Mortar ... | 54 | Newfoundland, Duties on Tea at ... | 136 |
| " Rubble, Cost of ... | 61 | New Land, Measurements for Opening ... | 5 |
| " in ... | 61 | " Metallic Roller ... | 68 |
| " Weight of ... | 9 | " South Wales, Duties on Tea at ... | 136 |
| Mortars and Cements, proportions ... | 55 | Newton, Laws of Motion ... | 1 |
| Moss and Lichen ... | 99 | New Zealand, Duties on Tea at ... | 136 |
| Motion and Force Defined ... | 2 | Nigeria, Duties on Tea at ... | 136 |
| " Laws of ... | 1 | Nitrate of Lime ... | 247 |
| Motor Bicycle Insurance ... | 343 | " of Potash ... | 247 |
| " Car Insurance ... | 343 | " of Soda ... | 247 |
| " Lorry, for 1 week on the Deltota Road, Galaha, Cost of running a ... | 78 | Nitric Acid to remove Putty ... | 37 |
| 2 type Halley's ... | 78 | Nitrogen as Manure ... | 241 |
| Mottling, Spots and Discoloration ... | 192, 193 | " in Dung from Bullocks ... | 231 |
| Mouldiness ... | 192 | " in Leguminous plants ... | 235 |
| Mouth Disease in Cattle ... | 350 | " in Tea ... | 126 |
| Moving Force Defined ... | 1 | Nitrolim ... | 247 |
| Mud Land, Measures ... | 12 | Non-corrosive Poisons ... | 286 |
| Muguna ... | 32 | " parasitic canker in Dogs ... | 365 |
| Mulberry ... | 254 | Norway, Duties on Tea at ... | 136 |
| | | Norfolk Islands, Duties on Tea at ... | 136 |
| | | Nose, Foreign Body in ... | 292 |
| | | Notes, Building ... | 52 |

| PAGE | PAGE |
|--|---|
| Notes, for Treatment of Labour 277 | Opium Supply of, to Superintendents ... 308 |
| „ Machinery ... 1 | Orange ... 254 |
| „ on Manuring ... 249 | „ River Colony, Duties on Tea at ... 136 |
| „ on the Care of Horses 365 | Ordinances ... 406 |
| „ Pages for 140, 336, 402, 450 | Births and Deaths 406, 407 |
| Nothopegia Colebrookii 29 | Branch Roads, Cost of 407 |
| Notifiable Diseases of Cattle 405 | Branding of Cattle 407 |
| Noxia, Hymenochaete 224 | Cattle Disease 407 |
| Number of Cubic Feet in Ton 7 | Cattle Trespass 407 |
| „ Rubber Trees per acre 162 | Cocoa Thefts Prevention 407 |
| „ Trees Pruned 117 | Deeds, Registration of 407 |
| Numbers, Products of 23 | Disease among Labourers 316 |
| Nurseries for Rubber, Cost of ... 162 | Diseases of Cattle 405 |
| Nurseries for Tea, Data re 87, 105 | Domestic Servants, Cost of ... 407 |
| „ „ „ Seed 87 | Equine Diseases 440 |
| „ „ „ Tea 105 | Export Duty on Tea, Cost of ... 407 |
| Nursery required for Seed at various distances, Table showing size of ... 87 | Fertilisers, Cost of 407 |
| Nut-, Coconut Seed ... 141 | Indian Coolies ... 407, 417 |
| Nut Store, Coconut ... 145 | „ „ Cost of 407 |
| Oaths and Affirmations | Insect Pest and Quarantine ... 407, 437 |
| Ordinance ... 407 | Insect Pest and Quarantine, Cost of ... 407 |
| Objections, Time allowed for 209 | Inventors, Cost of 407 |
| Obligations of Superintendents, Medical Wants ... 289 | Land Registration, Cost of 407 |
| Obstructing Medical Officer, Penalty ... 299 | Law of Evidence 407 |
| Occurrence of Bubbles in Sheet Rubber ... 170 | List of ... 407 |
| Ocean, Freights on Tea 138 | Manure and Fertiliser 407 |
| Offences, Vaccination 272, 331 | Medical Wants ... 297, 407 |
| Officer, Definition of Medical 297 | Mines and Machinery 407 |
| „ Duties of Medical 298 | Oath and Affirmations 407 |
| Offsets Explained ... 22 | Pradial Produce, Whipping for Theft of 407 |
| Oil, Carbolic ... 295 | Prevention of Diseases 316 |
| „ Cost of ... 68 | Rabies ... 441 |
| „ Engines ... 50 | Registration of Births and Deaths 407 |
| „ From Rubber Seed 163 | „ of Marriages 407 |
| „ Petroleum, Freight on 82 | „ of Deeds 407 |
| „ Rubber Seed for ... 164 | Rubber Thefts, Prevention 405, 407 |
| „ Streaks ... 192 | Servants, Artificers and Journeymen 408 |
| „ Weight of 10 | The Road Ordinance 407 |
| Old Paint, To remove 36 | Treasure Trove ... 407 |
| „ Putty, To remove 37 | Trespass of Cattle 407 |
| Opaque Rubber, Resinous or 193 | Vaccination ... 407 |
| Opening Coconut Land, Cost of 146 | Waste, Forest, Chena and Unoccupied Lands 437 |
| „ Rubber Land, Cost of ... 153, 161 | Will and Testamentary Dispositions ... 407 |
| „ New Land, Measurements for 6 | |
| „ Set of Books ... 379 | |
| „ Tea Land, Cost of 111 | |

INDEX

xxxiii

| | PAGE | | PAGE |
|--|--------------------|---|----------|
| Oriole not to be Exported | 436 | Patent Wire Shoot Runners | 71 |
| Ounces, Equivalent of | 8 | Patkela | 31 |
| Outdoor Government Dispensaries, Issue of Drugs from | 263 | Pattern Makers and Draughtsmen, Hints for | 18 |
| Over-smoking | 193 | Paving Bricks, Dimensions of | 53 |
| Ox, Power of an | 39 | Paying-off Labour | 408 |
| Oxide of Iron Paint | 37 | Payments on Account London | 205 |
| Oxy-acetylene Welding | 51 | Sales | 254 |
| Packages , Average Cost of | 123 | Peach | 254 |
| " Sizes of | 73 | Peck, Equivalent Capacities | 11, 12 |
| " of Light or Frail | | Pehimbiya | 28, 31 |
| nature, Rules re | | Pela, Equivalent Measurements | 11, 12 |
| Conveyance by | | Pelau | 31 |
| Rail of | 81 | Pelang Bokera | 33 |
| Tea and Rubber | 72, 196 | Penalty for Obstructing Medical Officer | 299 |
| Packing and Sorting Rubber | 188, 194 | P. & O. Parcel Rates | 84 |
| " for Tea, Rubber and | | Percentage of Profit on Rubber | 177 |
| Desiccated Coconuts | 80 | " " " Tea | 114 |
| " Material Required | 123 | Perch, Equivalent Measures | 12, 13 |
| " Rubber, The Ideal | | Perchloride, Liq. Hydrargyri, | |
| Case for | 172 | Uses of | 295 |
| " Tea | 87, 91, 126 | Piercopsis Mooniana | 31 |
| Padda Boats, Transport by | 92 | Pierphery, Velocity of | 45 |
| Pages for Notes | 140, 336, 402, 450 | Permanent Rubber Trees, | |
| Pains, Treatment for Neuralgic | 235 | Tapping | 166 |
| Paint, Asbestos | 37 | Permanenate of Potash, Its | |
| " Oxide of Iron | 37 | Uses | 294 |
| " To Remove Old | 36 | Persia, Duties on Tea at | 156 |
| Painting | 36, 37 | Persimmon | 254 |
| " Cost of | 64 | Personal Accounts | 370 |
| " Quantities | 37 | " Hygiene in the Tropics | 287 |
| Palaquium Pitio | 31 | Pern, Duties on Tea at | 136 |
| Palu | 31 | Peruvian Guano | 246 |
| Panukera | 31 | Pest, New Coconut | 148 |
| Paper Mulberry | 28 | " Ordinance, Fungus | 437 |
| Parasite of Coconut Beetle | 151 | " " Insect | 407, 437 |
| Parasitic Canker | 364 | " " Plant | 437 |
| Parcel Rates, Foreign | 83 | Pests, Danger of Fungoid | 104 |
| " Foreign Agency | 83 | Petroleum, Freight on | 82 |
| " Post Rates | 84 | Petter Engines | 50 |
| " System | 83 | Phenacetin, Its Uses | 294 |
| " Tariff, English | | Phyllanthus Indicus | 30 |
| Inland | 84 | Phytophthora Faberi, "Canker" | 226 |
| Parents to Report Births | 406 | " Pod Disease due to | 228 |
| " Vaccination Offences | 332 | Pineapples | 254 |
| Parrah or Bera Measures | 11, 12 | Pine, Weight of White | 10 |
| Parts of Rubber Machine, Worn | 194 | " Wood Floor Boards | 63 |
| Passion Fruit | 254 | Pink Disease | 229 |
| Patent Triple-action Tea | | Pints | 8 |
| Roller, Brown's | 68 | Piroplasmiasis | 354 |
| " Venesta Rubber Packages | 73, 196 | Pithecolobium Dulce | 28 |
| | | " Saman | 28 |
| | | Plague, or Murrain, Cattle | 351 |

| | PAGE | | PAGE |
|------------------------------|--------------|------------------------------------|------------|
| Plan, Computing Areas on a | 17, 21 | Portland Cement | 55 |
| Plant Diseases Ordinance | 437 | " " to Stand | |
| " Fumigation, Procedure | 440 | Heat | 56 |
| " Trees to | 28 | Portugal, Duties on Tea at | 136 |
| Plantation Rubber | 201 | Portuguese India, Duties on | |
| " " Account | | Tea at | 136 |
| Sales of | 197 | Postage Charges to United | |
| Sales Conditions | 201 | Kingdom | 84 |
| Tender form of | 203 | Post Rates, Parcel | 84 |
| Planters' Vade Mecum, Tea | 124 | " System, Parcel | 83 |
| Planting, Square | 250 | " Tariff, English Inland | |
| " Tea | 85, 90 | Parcel | 84 |
| " Triangular | 250 | Potash as a Manure | 247 |
| Plants, Cost of rearing, Tea | 110 | " Chlorate, Its Uses | 294 |
| " " of Tea | 92 | " Nitrate of | 247 |
| " Nitrogen in Leguminous | 235 | " Permanganate of | 294 |
| " to be Disinfected, | | Pound Defined, Foot | 45 |
| Imported | 438 | Pounds Avoir, Equivalents | 8 |
| " Straws, Cadjans, etc., | | Power Defined, Horse | 39, 45 |
| Rules re Conveyance | | " for Raising Water | 43, 45, 46 |
| by Rail of | 81 | " " a Water Wheel | 43 |
| Plaster Cement | 57 | " of Hospital Visitors | 308 |
| " Lime to Walls | 57 | " " Soils, Safe-bearing | 53 |
| " Paint required for | 37 | " " Turbines | 47 |
| Plastering, Cement | 56 | " " Various Litters, | |
| " " Cost of | 63 | Absorptive | 242 |
| Platinum, Weight of | 9 | " " to set off, London Sales | 209 |
| Pleurisy in Dogs | 363 | Powers of Inquirers | 403 |
| Ploughing Coconuts | 142 | " Relative | 39 |
| Plucking Tea Leaf | 91, 101, 117 | " Visitors, Hospital | 308 |
| " " Whole-Leaf" | 101 | Prædial Produce Theft Ordin- | |
| Plum | 254 | ance | 407 |
| Plumbago, Weight of | 9 | Precautions for Rabies | 356 |
| Pneumonia | 283 | Preliminary Treatment of | |
| " in Dogs | 362 | Latex | 190 |
| Pocket Check Roll | 373, 393 | Premium for Fire Insurance | 339 |
| Podophyllin Pills, Use of | 294 | Preparation of Rubber | 191 |
| Point, Boiling | 10 | Prepared Rubber, Fungoid | |
| Points on a Curve, To find a | | Spot Disease in | 184 |
| Centre Common | 21 | Prescriptions for Estates | 263, 264 |
| Poisoning | 276 | " few, A | 295 |
| " Corrosive | 285 | Pressure on Brickwork and | |
| " How to Act | 285 | Concrete | 53 |
| Pol (Coconut) | 31 | Prevention and Suppression of | |
| Police and Headmen | 297, 405 | Rinderpest | 352 |
| " Magistrate, Unofficial | 405 | " of Anthrax | 349 |
| Policies, Floating Insurance | 338 | " " Cacao Thefts | |
| " Warrants to be In- | | Ordinance | 407 |
| serted in | 337 | " " Cattle Disease | 350 |
| Pollarding Shade Trees | 91 | " " Coconut Pest | 151 |
| Pometia Eximia | 31 | " " Diseases Ordin- | |
| Pony, Power of a | 39, 45 | ance | 316 |
| Poochies in Upholstery | 38 | " " Insect Pests | |
| Poonacs | 246 | Ordinance | 437 |
| Poria Hypobrunnea | 224 | " " Rabies | 358 |

INDEX

XXXX

| PAGE | PAGE |
|----------------------------------|-------------------------------------|
| Prevention Rubber Thefts | Quadraat Roeden ... 12 |
| Ordinance 405; 407 | " Voeten ... 12 |
| " " Scale in Boilers 49 | Qualify for Rebate, Med. |
| " " Surra ... 354 | Wants, To ... 309 |
| Preventive Inoculation 353 | Quality and Grading of |
| " Measures, Anchy- | Rubber ... 187 |
| lostomiasis 259 | " of Rubber Defined, |
| Price of Cadjans ... 92 | Standard ... 204 |
| Prices of Steel Road Bridges 73 | Quantity of Manure to Apply |
| P. C. M. O. may Direct Inspec- | per Tea Bush ... 253 |
| tion ... 318 | Quantities, Painting ... 37 |
| Principles of Mechanics 1 | " Sowing ... 13 |
| Prize Essay on Tea Pruning 93 | Quarantine Ordinance ... 407 |
| Products of Numbers ... 26 | " Rules in Certain |
| Production, Approximate Cost | Diseases... 271 |
| of Rubber ... 159 | Quart, Equivalent Capacities 11, 12 |
| Producing Tea per lb., Approxi- | Queensland, Duties on Tea at 136 |
| mate Cost of ... 113 | Quicklime for Removing Paint 36 |
| Profit and Loss Statement 369 | Quicksand, Safe-bearing |
| " Tables, Rubber ... 174 | Power of ... 53 |
| " " Tea ... 114 | Quicksilver, Boiling Point 10 |
| Prohibition re Exportation | Quinine, Regulations re 263, 308 |
| of Birds ... 436 | " When to be Taken 295 |
| Projectile ... 1 | Rabies in the Dog ... 354 |
| Prompt, Definition of ... 202 | " Ordinance ... 441 |
| Property, Profit on Tea 114 | Radius of a Circle ... 18 |
| Propping Coconut Trees 143 | Rail-freight on Manure 254 |
| Provisions as to Tea, Food and | Rails, Cost of Railway 66 |
| Drugs Act 132 | Railway, Coaching Regula- |
| " Financial ... 303 | tions ... 80 |
| Pruned, Number of Trees 117 | " Goods, Classification 82 |
| Pruning, Direction of Cut in 99 | " Rails, Cost of 66 |
| " Following a Cut | " Rules re Conveyance |
| Down ... 100 | of Goods per 80 |
| " Height for Tea 98 | " Trucks, Capacity of 199 |
| " Knives, Varieties 99 | Rain Tree ... 28 |
| " Systems of ... 95 | Rainfall, Formula for Measuring 34 |
| " Tea ... 91 | " Memoranda ... 34 |
| " " Analysis of 116 | Ram, Hydraulic ... 40 |
| " " Umbrella" 101 | Rash in Small-pox ... 333 |
| " Use of Saw and Tar in 99 | Rat Destruction ... 33 |
| Prunings, Burying of Tea 91, 104 | Rates, Agency, Chamber of |
| Pterocarpus, Indicus, etc. 28 | Commerce ... 435 |
| " Marsapium 29 | " Building and Car- |
| Public Works Department, | pentry rates 76 |
| Cubing Metal ... 13 | " for Govt. Dispeasing 307 |
| Pulleys, Diameter of ... 4 | " Foreign Parcels 83 |
| " Powers of Various 1 | " Masonry ... 75 |
| " Speed of ... 4 | " of Agency, Commission |
| Pumps, Data re ... 45 | and Brokerage 435 |
| Putty, Cost of ... 64 | " Parcels ... 84 |
| " To make ... 38 | " Short Period Insurance 337 |
| " To remove Old 37 | "Rapid" Tea Roller, Square 68 |
| Quadraat , Duim ... 12 | Rearing Tea Plants, Cost of 109 |

| | PAGE | | PAGE |
|---|----------|---|---------------|
| Reaumur, Equivalent of | 10 | Re-weights, Rubber | 205 |
| Rebates for Estate Hospitals | 309 | Rhenish Morgen, Equivalent of | 12 |
| Recipes | 35 | Rhizophora Mucro | 30 |
| Reception of Latex | 190 | Right Angle, To lay out | 18 |
| Recommendations of the R. G. Association | 189 | Rights of Superintendents | 299 |
| Reconstruction of Cooly Lines, Imperative | 319 | Rinderpest, Treatment for | 296, 351 |
| Recovery of Charges, Medical Wants Ordinance | 300 | Risks, Insurance | 337 |
| Rectangular Notch Weir Table | 44 | Road Bridges, Prices of Steel | 74 |
| System | 252 | Material | 62 |
| Rectified Spirits | 294 | Metal, Cost of | 62 |
| Red Coconut Beetle | 148 | Roading an Estate, Tea | 89 |
| Redaway Camel Belting | 38 | Roads, Construction of | 62 |
| Reduce Longitude to Time | 34 | Cost of | 62 |
| Square Links to Acres | 18 | Ordinance, Branch | 407 |
| Time to Longitude | 34 | Ordinance | 407 |
| Red Water | 354 | Robey & Co., Engines | 51 |
| Regarding Cement | 57 | Rock, Safe Bearing Power of | 53 |
| Register, Macadam & Cooly | 396 | Rod of Brickwork | 53 |
| Registration of Births and Deaths Ordinance | 407 | Roeden, Dutch Measures | 12 |
| of Deeds | 407 | Roll, Check | 372, 390, 394 |
| of Domestic | 407 | Pocket Check | 393 |
| Servants | 407 | Rollers, Cost of Tea | 68 |
| of Marriages Ordinance | 407 | Rolling Tea | 124 |
| Ordinance, Land | 407 | Rood, Measurement of | 13 |
| Regulations, Coaching, Rule re | 80 | Roofing, Cost of | 63 |
| Equine Diseases | 440 | Cost of Continuous Iron | 63 |
| Fire Insurance | 345 | Cost of Corrugated | 64 |
| for the Issue of Medicine, Estates | 263 | Felt | 60 |
| Insect Pest and Quarantine Ordinance | 438, 439 | Iron, Cost of | 63 |
| Tea Taring | 134 | Tiles, Cost of | 65 |
| Vaccine Department | 323 | Roofs, Cost of Iron | 63 |
| Relative Cost of Coal and Wood | 70 | Leaks in | 35 |
| Remarks on Book-keeping | 377 | Nails required for Various | 64 |
| Remedy and Prevention of Coconut Pests | 151 | Wood | 59 |
| Removing Old Paint | 36 | Root Diseases of Hevea Brasiliensis | 223 |
| Old Putty | 37 | Treatment of | 225 |
| Repens, Sphaerostyle | 224 | Ropeways, Aerial | 71 |
| Report, Monthly | 376 | Ropes, Cost of Wire Shoot Tables of Strength | 71 48 |
| Required Force to move a Body | 2 | Rot on the Tapped Surface, Bark | 227 |
| Resinous & Opaque Rubber | 192 | Dry, in Buildings | 35 |
| Result of crushing undeorticated Rubber Seed | 165 | Roumania, Duties on Tea at | 136 |
| Returns from Coconut Estate | 148 | Rubber | 153 |
| Revaccination, When Necessary | 325 | Account Sales | 197 |
| | | Acres Planted | 185 |
| | | Air Bubbles | 170 |
| | | Association of London, Rules | 201 |
| | | Average Weight of Packages | 199 |
| | | Bark Rot on the Tapped Surface of | 227 |

| | PAGE | | PAGE |
|---------------------------|----------|-----------------------------|----------|
| Rubber, Bubbles in Sheet | 170 | Rubber Labour, Average Work | 161 |
| .. Case for Packing, The | | .. Land, Cultivation of | 161 |
| Id-al ... | 172 | Drainage | 161 |
| .. Cases Strong ... | 173 | .. Machinery, Care of | 193 |
| .. Chests, Cost of | 73 | Lubrication of | 193 |
| .. Coagulation of | 190 | .. Nurseries ... | 162 |
| Hot and | | .. Over-smoking | 193 |
| Cold ... | 216 | .. Packages ... | 73, 196 |
| .. Colombo Sales | 199 | Average Weight | 199 |
| .. Colour ... | 194 | .. Packing ... | 182, 194 |
| .. Contracts, Delivery | | .. Plantation ... | 201 |
| of | 207, 208 | .. Preparation of | 191 |
| Shipment | 208 | .. Production, Approximate | |
| .. Conveyance by Rail, | | Cost of Hevea | 159 |
| Rules, etc. | 80 | .. Purchased, When may | |
| .. Cost of hinging into | | be | 406 |
| bearing | 153 | .. Quality and Grading | 187 |
| .. Cost of Opening | | .. Prices Realizable | 162 |
| Land | 153, 161 | .. Re-weights ... | 205 |
| F. O. B. | 188 | .. Rules, London | 201 |
| .. Crepe, Coagulating | | for Conveyance | |
| for | 190 | by Rail | 80 |
| .. Crops, Approximate | | .. Sales Account | 197, 350 |
| Hevea | 159 | Colombo | 199 |
| .. Curing of Rubber, Re- | | London | 201 |
| commendations for | 189 | .. Samples, Vulcanisation | |
| .. Dark Glossy Surface | | Tests on Rubber | 214 |
| of | 193 | .. Scheme for Thinning | 168 |
| .. Defined by Ordinance | 406 | .. Seeds and Nurseries | 162 |
| .. Delivery Contracts | 207, 208 | Cost of ... | 164 |
| Weights | 205 | Crushing undecorti- | |
| .. Details of Expendi- | | cated | 166 |
| ture on | 160 | Data re | 163 |
| .. Duties on | 187 | For Oil, Hevea | 164 |
| .. Estate Expenditure | 180 | .. Sheet, Coagulating for | 191 |
| .. Estates, Labour for | 161 | Smoked | 168 |
| Work for Cooly | 161 | .. Sheets to be Thick | 192 |
| .. Estimate for Opening | | .. Shipment Contracts | 208 |
| Land | 153 | .. Sorting and Grading | 194 |
| .. Export Duties on | 187 | and Packing | 188 |
| .. Factories, Cost of | 195 | .. Superintendence of | |
| Insuring | 342 | Estate, Cost of | 153 |
| .. Factory, In the | 190 | .. Surface of | 193 |
| .. Fungoid Spot Disease | 184 | .. Tables of Profits | 177 |
| .. Glossy Surface of | 193 | .. Thefts Ordinance | 405, 407 |
| .. Grading and Quality of | 187 | .. Thickness of | 192 |
| Sorting of | 194 | .. Trees, Alternate Day | |
| .. Growers' Association, | | Tapping | 167 |
| Recommendations | 189 | Table showing Dis- | |
| .. General Charges, | | tances, Numbers | 162 |
| Estate | 153 | .. Trees, Tapping Experi- | |
| .. Hevea, Cost of bring- | | ments | 165, 166 |
| ing into bearing | 153 | .. Weight of, per Pack- | |
| .. Ideal Case for Packing | 172 | age | 199 |
| .. Inferior to Guarantee | 208 | Rubble, Cost of Dry | 61 |

| | PAGE | | PAGE |
|--|------|---|--------|
| Rubble in Mortar ... | 61 | Sand, Safe Bearing Power of ... | 53 |
| " " Cost of ... | 61 | " Weight of ... | 10 |
| Ruk ... | 32 | Sapu ... | 28, 31 |
| Rukettana ... | 32 | Sarcocephalus Cordatus ... | 29 |
| Rules, Coaching Regulation ... | 80 | Satinwood ... | 29 |
| " Disinfection ... | 270 | " Weight of ... | 10 |
| " Factories ... | 442 | Saturated Mixtures of Air ... | 121 |
| " For Guidance of Estate Proprietors ... | 308 | Saw in Pruning, Use of ... | 99 |
| " of Coaching Regulations ... | 80 | Sawyer's Measurements ... | 27 |
| " of Health, Simple ... | 286 | Scale in Boilers, Prevention of ... | 49 |
| " of the Conveyance of Goods on Ceylon Govt. Railway, Extracts from the ... | 80 | " of Fees to Med. Offs. for Judicial Work ... | 316 |
| " Medical Wants Orphanage ... | 306 | Scandinavia Belting ... | 39 |
| " Plantation Rubber ... | 201 | Scantlings, Table of ... | 59 |
| Runners, Wire Shoot ... | 71 | Scheme for Thinning Rubber ... | 168 |
| Running a 2 type Hally's Motor Lorry for 1 week on the Deltota Road, Galaha, Cost of ... | 78 | Schleichera Trijunga ... | 30 |
| Russia, Duties on Tea at ... | 137 | Scorpion Bite, Treatment ... | 295 |
| Russian Teas ... | 128 | Scotch Granite, Weight of ... | 9 |
| " Duty on ... | 128 | Seasons, British Tea ... | 123 |
| Rust Joint Cement ... | 35 | Section, Tea ... | 85 |
| " Stretching Rusty, Resinous or Opaque ... | 193 | Seducing a Labourer ... | 414 |
| Ruston Proctor Engines ... | 50 | Seed, Coconut ... | 141 |
| Safe Bearing Power of Soils ... | 53 | " Crushing undecorticated Rubber ... | 165 |
| " Pressure on Brickwork and Concrete ... | 53 | " Rubber, Cost of ... | 162 |
| Safety Valve ... | 448 | " " Data re... .. | 163 |
| Sal Ammoniac ... | 35 | " " For Oil ... | 164 |
| " Congealing Point ... | 10 | " " Nurseries ... | 162 |
| " Volatile, Uses of ... | 294 | " Selection of Coconut ... | 141 |
| Sale of Food and Drug Act ... | 132 | " Tea ... | 85 |
| Sales Account, Rubber... .. | 390 | " At Stake ... | 86 |
| " Tea ... | 390 | " " Germinating ... | 86 |
| " Colombo Rubber ... | 199 | " " Nurseries ... | 87 |
| " Tea ... | 129 | " " Size of ... | 87 |
| " Conditions of ... | 129 | " " Packing ... | 87 |
| " London Conditions of ... | 131 | " " Testing ... | 85 |
| " Date of ... | 83 | Seer, Equivalent Capacities ... | 11 |
| " Rubber, Account ... | 197 | Selection of Coconut Seeds ... | 141 |
| Salmonicolor, Corticium ... | 229 | Selling Tea in London ... | 133 |
| Salts, Potash ... | 248 | Semecarpus Gardneri ... | 32 |
| Samoa, Duties on Tea at ... | 137 | " Subpeltata ... | 32 |
| Samples, Rubber ... | 205 | Semitostus, Fomes ... | 223 |
| " Vulcanisation Tests on Rubber ... | 214 | Serious Injury in Factory, Reportable ... | 446 |
| Sampling, Tea in London ... | 133 | Serawa, Equivalent Measures ... | 12 |
| Sand, Cubic Feet in Ton ... | 7 | Servants' Ordinance ... | 407 |
| | | Set off, Power to ... | 209 |
| | | " of Books, To Open ... | 379 |
| | | Several Pulleys, Power of ... | 4 |
| | | Seychelles, Duties on Tea at ... | 137 |
| | | Shade Trees for Tea ... | 91 |
| | | " " Pollarding ... | 91 |
| | | Shading Tea ... | 90 |
| | | Shaffling, Speed of ... | 4 |
| | | Shavings, Bark ... | 189 |

INDEX

xxxix

| | PAGE | | PAGE |
|----------------------------------|----------|----------------------------------|------|
| Sheet, Balance ... | 374 | Sodium Bisulphite ... | 190 |
| „ Rubber, Coagulating for | 191 | Soft and Hard Water ... | 34 |
| „ „ Occurrence of | | Soil Analyses of Ceylon ... | 233 |
| „ „ Bubbles in ... | 170 | „ „ Conditions for Manuring | 231 |
| „ „ Smoked Rubber ... | 168 | „ „ Cubic Feet in a Ton ... | 7 |
| Sheets should be Thick ... | 192 | „ „ Moisture in Cultivated and | |
| Shingle Roofing, Cost of ... | 64 | „ „ uncultivated ... | 232 |
| Shingles, Cost of ... | 65 | Soils, Safe Bearing Power of ... | 53 |
| „ „ Data <i>re</i> ... | 65 | Soldering ... | 60 |
| Shipment Contracts for Rubber | 208 | Solid Measure ... | 7 |
| Shipping Ton, Equivalent of ... | 138 | Solvency Guarantee, London | |
| Shooks, Weight of ... | 127 | „ Sales ... | 209 |
| Shoots, Wire ... | 71 | Soorkie Concrete Floor, Cost of | 63 |
| „ „ Runners ... | 71 | Sore Backs (Horses) ... | 367 |
| Short Period Insurance Rates | 337 | „ „ Eyes, Treatment ... | 295 |
| Sick Cooiy, Rights of a ... | 417 | Sorting and Grading Rubber | 194 |
| „ „ Daily State of ... | 279 | „ „ Packing Rubber ... | 188 |
| Side-branches useless, Trailing | 100 | South Africa, Duties on Tea at | 137 |
| „ „ of Inscribed Cube ... | 18 | „ „ Australia, Duties on | |
| Sierra Leone, Duties on Tea at | 137 | „ „ Tea at ... | 137 |
| Sifters, Green Leaf ... | 121 | „ „ Rhodesia, Duties on | |
| Sifting Green Tea ... | 121 | „ „ Tea at ... | 137 |
| „ „ Large and Small Bulk | 106 | „ „ West Monsoon, Pod | |
| „ „ Tea ... | 106 | „ „ Di-ease ... | 228 |
| „ „ for London ... | 106 | Southern Nigeria, Duties on | |
| Silver, Weight of ... | 9, 10 | „ „ Tea at ... | 137 |
| Simple and Compound Interest | 24 | „ „ Province, Wet Measure | 12 |
| „ „ Rules of Health ... | 286 | Sowing Quantities ... | 13 |
| Sinhalese Recipes ... | 38 | Space Traversed, Defined ... | 2 |
| Sirocco, Tea Dryers ... | 69 | Spain, Duties on Tea at | 137 |
| Site for Coconut Desiccating | | Speed Defined ... | 1 |
| „ Mills ... | 144 | „ „ Main Shaft ... | 3 |
| Size of Breaks ... | 128 | „ „ of Engines ... | 2 |
| „ „ of Nursery required for Seed | | „ „ „ Machines ... | 3 |
| „ „ at various distances ... | 87 | „ „ „ Pulleys ... | |
| Sizes of Packages ... | 73 | „ „ „ Shafting ... | 5 |
| Slag, Basic ... | 248 | Sphaerostible Repeats ... | 224 |
| Slaked Lime, Cost of ... | 92 | Sphere, Surface of ... | 18 |
| Slate, Weight of ... | 10 | „ „ Equivalent Diameter of | 18 |
| Slopes, Larger Number of | | Spirits Rectified, Use of ... | 295 |
| „ „ Trees on ... | 5 | Spoons, Capacity of ... | 8 |
| Small Bulk Sifting ... | 106 | Spot Disease in Rubber | 184 |
| „ „ Bushes, Treatment of ... | 98 | Spots and Discolorations, | |
| „ „ or Loose Articles, Rules | | „ „ Motting ... | 192 |
| „ „ <i>re</i> Conveyance by | | Sprains ... | 273 |
| „ „ Rail of ... | 80 | „ „ and Bruises, Lotion for | 295 |
| Small-pox, Diagnosis of ... | 332 | Square Cistern, Capacity of | 8 |
| „ „ Treatment „ ... | 284 | „ „ Definition of a ... | 60 |
| Smoke Curing, Rubber ... | 192 | „ „ Links, Reduced to Acres | 18 |
| Smoked Rubber Sheet ... | 168 | „ „ Measures „ ... | 8 |
| Smoking Rubber, Hints for | 186 | „ „ of Numbers ... | 26 |
| „ „ Over ... | 193 | „ „ Planting ... | 250 |
| Snake Bite, Treatment ... | 293, 295 | „ „ „ Rapid „ Tea Roller | 68 |
| Soda, Nitrate of ... | 247 | „ „ Roof of Sphere, | |
| „ „ Prevents Scale in Boilers | 49 | „ „ Equivalents ... | 18 |

| | PAGE | | PAGE |
|--------------------------------|--------|----------------------------------|----------|
| Square side of a, Equivalents | 19 | Suction Gas Engines | 51 |
| " System | 252 | Sudden Deaths, Procedure | 403 |
| Stable Equilibrium | 1 | Sulphate of Ammonia | 247 |
| Stain for Wood | 58 | " of Quinine, How to | |
| Staining Wood | 58, 59 | procure | 263 |
| Stake, Tea Seed at | 86 | " of Zinc, Its Uses | 294 |
| Stanchions, Foundations to | | Sulphur, Flower of | 35 |
| Columns and | 54 | Sulzer Engines | 50 |
| Stand Heat, Portland Cement to | 56 | Summary of the Vulcanisation | |
| Standard Qualities of Rubber | 204 | Tests on Rubber | 214 |
| Standardisation of Rubber | 187 | Summons | 403 |
| State of Sick, Daily | 279 | Sun Dried Bricks | 52 |
| Statement of Profit and Loss | 369 | " Exposure | 292 |
| " showing Apportion- | | Sunaptia Scarbrinscular | 31 |
| ment Charges, Tea | 120 | Sundries, Tea Factory | 92 |
| St. Christopher and Nevis, | | Superficial versus Base Measure- | |
| Duties on Tea at | 137 | ment | 5 |
| Steam, Carpentry and | | Superintendence, Rubber | |
| Insurance | 338 | Estates | 153 |
| " Engines | 51 | Supdt., Vaccination Offences of | 331 |
| " Power, Rules | 443 | Supdts. Instructions for Guid- | |
| " Weight of | 10 | ance of | 266 |
| Steamer Freights | 83 | " Medical Instructions to | 263 |
| Steel Road Bridges, Prices of | 74 | " Rights, Duties and | |
| " Weight of | 9 | Obligations | 299 |
| Steelyard | 1 | " Supply of Drugs | 308 |
| Stem Diseases | 226 | " to give Notice of | |
| Stemonoporus Wightii | 29 | Disease | 317 |
| Sterculia Fœtida | 31 | Superphosphate | 247 |
| Stereospermum Chleno | 30 | Supervision of Reception of | |
| St. Helena, Duties on Tea at | 137 | Latex | 190 |
| Stings of Wasps and Bees | 293 | Suppression of Rinderpest | 352 |
| St. Lucia, Duties on Tea at | 137 | Supply of Drugs to Supdts. | 308 |
| St. Nevis, Duties on Tea at | 137 | Supplying a Tea Estate | 90 |
| Stock Bricks, Dimensions of | 52 | Supreme Court Witnesses | 404 |
| Stone Grey Wash for Walls | 37 | Surface, Equivalent of | 18 |
| " Paint required for | 37 | " of a Sphere | 18 |
| Strawberries | 254 | " of Rubber, Bark Rot on | |
| Straws, Cadjans, etc., Rules | | the Tapped | 227 |
| Conveyance by Pail of | 81 | " of Rubber, Dark- | |
| Streaks, Dark | 192 | Glossy | 193 |
| " Oil | 192 | " Paint will Cover | 37 |
| Stream, Measuring Water | | Surgical Implements, etc. | 268 |
| in a | 42 | Suriya | 31 |
| Strength of Chains | 48 | Suriyamara | 28, 31 |
| " of Coagulant | 190 | Surra | 353 |
| " of Ropes | 48 | Surveying | 6 |
| Straining of Latex | 180 | Sweden, Duties on Tea at | 137 |
| String Tenders | 205 | Switzerland, Duties on Tea at | 137 |
| St. Vincent, Duties on Tea at | 137 | Symptoms of Anchylostomiasis | 256 |
| Subacetate of Lead, Liq. of, | | " Anthrax | 349 |
| Its Uses | 295 | " Rabies | 355 |
| Subdivision of Weeding Con- | | " Red Water | 354 |
| tract | 17 | " Rinderpest | 296, 351 |
| Substances, Weights of | 9 | " Small-pox | 284 |

| | PAGE | | PAGE |
|--------------------------------|----------|-----------------------------|----------|
| Symptoms of Surra | 353 | Taring Regulations | 134 |
| System, Equilateral Triangular | 251 | Tar in Pruning, Use of | 99 |
| " Macadam's Cooly | 398 | Task and Load Maximum for | |
| Metric | 7, 8 | Cooly | 412 |
| " of Pruning Tea | 95 | Daily | 100 |
| " of Tapping Rubber | | Tasmania, Duties on Tea at | 137 |
| Trees | 165 | Tasting Tea | 124 |
| " Parcel Post | 83 | Tats | 108 |
| " Rectangular | 252 | Tea | 85 |
| " Square | 252 | Average Composition of | 106 |
| " "Whole-Leaf" | 101 | Bolking in London | 133 |
| Tables for Ascertaining Dates | 25 | Burying of Prunings | 91 |
| " Pumping Water | 46 | Bush, Quantity of Manure to | |
| " for Reducing Hypotenuse | | apply per | 252 |
| to Base | 7 | Bushes, Analysis of the | |
| " of Scantlings | 59 | Prunings of | 116 |
| " of Interest | 24 | Centering | 91 |
| " Profits on Rubber | 174, 177 | Chests, Cost of | 73, 123 |
| " on Tea | 114 | Clearing and Felling | 89 |
| " Showing Products of | | Colombo Charges | 113 |
| Numbers | 26 | Composition of | 106 |
| " Distances and | | Cost of, per lb. | 112, 113 |
| Numbers of Rub- | | " of Producing | 112 |
| ber Trees | 162 | " of Production | 112 |
| " Size of Nursery re- | | Crop, Statement showing | |
| quired for Seed | | Apportionment of Charges | |
| at various Dis- | | of Cost of Ceylon | 120 |
| tances | 87 | Cup, Capacity of | 8 |
| " Strength, Chains | 48 | Drainage of | 90 |
| Ropes | 48 | Drying | 86, 124 |
| Tablespoon, Capacity of | 8 | Duties on | 135 |
| Tables, Weir | 43, 46 | Equivalent Value of | 118 |
| Tackiness | 192 | Factory Bulkcd | 126 |
| Tackle of Horses | 366 | " Light Installation | 451 |
| Talawakelle Engineering Works, | | " Sundries | 92 |
| Engines | 50 | Factories Cost of | 72 |
| Tangyes Suction Gas Plant | 50 | " Wood Frel for | 69 |
| Tank Capacities | 8 | Felling and Clearing | 89 |
| Tapped Surface, Bark Rot | | Filling in | 89 |
| on the | 227 | Food and Drug Act | 132 |
| Tapping Permanent Rubber | | For America | 123 |
| Trees | 166 | Freight on | 138 |
| " Rubber Trees, Alternate | | Fuel for Manufacture | 91 |
| Day | 187 | Height for Pruning | 98 |
| " Rubber Trees, Experi- | | Holing | 89 |
| ments | 165 | How to Infuse | 125 |
| Tar Deposits | 193 | Importable only via | |
| " One Gallon will Cover | 37 | Colombo | 439 |
| Tare, Definition of | 128 | " In Colombo, Equivalent | |
| " of Tea | 126 | Value of | 119 |
| Tariff, English Parcel Post | 84 | Infusing Ceylon Tea | 125 |
| " Insurance | 337 | Ingredients of | 116 |
| " Rates, When | | Inspection in London | 133 |
| Increased | 340 | Jats of Ceylon | 97 |
| | | Land, Cost of Opening | 111 |

| | PAGE | | PAGE |
|--------------------------|---------|----------------------------------|----------|
| Tea Land, Cultivation of | 111 | Tea Seed, Testing | 86 |
| " Landing in London | 133 | " Selling in London | 133 |
| " Leaf, Plucking | 117 | " Shade Trees for | 91 |
| " " Sifters, Green | 121 | " Shading | 90 |
| " " Value of Green | 116 | " Sifting | 106 |
| " " Transport | 120 | " " for London | 106 |
| " Leaves, Composition of | 106 | " Spoon, Capacities of | 8 |
| " Lines | 92 | " Supplying | 90 |
| " Lining | 89 | " Taring Regulations | 134 |
| " Manufacture, Cost of | 91 | " Tasting | 124 |
| " " of Green | 187 | " To obtain Maximum | |
| " Manuring | 91 | " " Arona | 125 |
| " " Cost of | 91 | " To Users of | 125 |
| " Nitrogen in | 126 | " Transport | 91 |
| " Nurseries | 87, 105 | " Treatment of small | |
| " " Cost of | 105 | " " Bushes of | 98 |
| " Ocean Freights on | 138 | " Value in Colombo and | |
| " Packages, Cost of | 123 | " London | 118 |
| " Packing | 91, 126 | " Weeding | 90 |
| " " for Rubber, and | | " Weighing | 126 |
| " " Deoicated Coconuts | 80 | " Withering | 122 |
| " Planters' Vade Mecum | 124 | Teak, Shingle Roofing, Nails | |
| " Planting, Cost of | 90 | " required for | 64 |
| " Plants, Cost of | 92 | " Shingles, Cost of | 65 |
| " " Rearing | 109 | " Weight of | 10 |
| " Plucking | 91, 101 | " Wood, Cost of | 85 |
| " " Cost of | 91 | " " Doors and Windows | 65 |
| " Pollarding Shade Trees | 91 | Teal not to be Exported | 436 |
| " Property, Profit on | 114 | Teas, Indian and Ceylon | 131 |
| " Pruning | 91 | Technical Terms and Definitions, | |
| " " Analysis of | 116 | " Electricity | 456 |
| " " Height for | 98 | Telamba | 31 |
| " " Knives | 99 | Tel Kekuna | 32 |
| " " Prize Essay on | 93 | Tenders, Rules Governing | |
| " Roading a Tea Estate | 89 | " Rubber | 202 |
| " Roller, Brown's Patent | | " Form of | 203 |
| " Triple-action | 68 | " String | 205 |
| " Rollers, Cost of | 68 | Tennis Court, To lay out | 20 |
| " Rolling | 124 | Tephrosia Candida | 236 |
| " Rules of Conveyance by | | Term Insurances, Long | 338 |
| " Rail of | 80 | Terminalia Beleri, etc. | 29 |
| " Russian | 128 | " Glabra | 30 |
| " Sales Account | 390 | " Parviflora | 29 |
| " " Colombo | 128 | Testamentary Dispositions | |
| " " Conditions | 129 | " Ordinance | 407 |
| " " London | 131 | Testing Tea Seed | 86 |
| " Sampling in London | 133 | Tests, Summary of Vulcanisa- | |
| " Seasons, British | 123 | " tion | 214 |
| " Section | 85 | " Vulcanisation | 210 |
| " Seed (see Segh) | 85 | Tetrameles Nudiflora | 32 |
| " " at Stake | 86 | Thefts Ordinance, Prevention | |
| " " Fumigation, Pro- | | " of Cacao | 407 |
| " " cedure | 440 | " Prevention of Rubber | 405, 407 |
| " " Terminating | 86 | Theobromae, Botryodiplodia | 229 |
| " " Packing | 87 | Thespesia Popul | 31 |

| | PAGE | | PAGE |
|------------------------------------|--------|-------------------------------------|----------|
| Thickened Edges ... | 193 | Treatment of Dogs ... | 359 |
| Thickness of Brickwalls ... | 53 | " " Estate Labourers ... | 277 |
| " of Rubber ... | 192 | " " Latex ... | 189 |
| Thinning Rubber, Scheme for ... | 166 | " " Kinderpest ... | 352 |
| Thrush (Horses) ... | 366 | " " Root Disease ... | 225 |
| Tiled Roof, Nails required for ... | 64 | " " Small Bushes ... | 98 |
| Tiles, Cost of Roofing ... | 65, 92 | " " Surra ... | 354 |
| " Calicut, Cost of ... | 65 | Trees, Distances of Rubber ... | 162 |
| " Glass ... | 65 | " Number of, To an Acre ... | 162 |
| " Mangalore, Data ... | 60 | " Pollarding Shade ... | 91 |
| " Native, Data ... | 60 | " Pruned, Number of ... | 117 |
| " Ridge, Cost of ... | 65 | " Shade ... | 91 |
| " Roofing ... | 65 | " Tapping Permanent ... | |
| " Square, Dimensions of ... | 53 | Rubber ... | 166 |
| Tiling ... | 60 | " " Rubber, ... | |
| Tilling Coconut Land ... | 142 | Experiments ... | 165 |
| Timber, Ceylon ... | 27 | " " To Plant ... | 28 |
| " Measurements ... | 27 | Trellis-work, Cost of ... | 64 |
| " Unwrought, Rules re ... | | " " Nails re- ... | |
| Conveyance by Rail of 80 ... | 80 | quired for ... | 64 |
| Time allowed for Claim or ... | | Trema Orientalis ... | 28, 29 |
| objection, Rubber ... | 209 | Trespass of Cattle Ordinance ... | 407 |
| " for Pruning Tea ... | 93 | Trial Balance ... | 374, 392 |
| " of Vulcanisation ... | 212 | Triangular Planting ... | 250 |
| " Reduced to Longitude ... | 34 | " System, Equilateral ... | 251 |
| Tin, Weight of ... | 9, 10 | Trichadeniya Zeylan ... | 31 |
| Tincture of Arnica ... | 294 | Trinidad and Tobago, Duties ... | |
| Tinniya ... | 32 | on Tea at ... | 137 |
| Tobago, Duties on Tea at ... | 137 | Triple-Action Tea Rollers ... | 68 |
| Togoland, Duties on Tea at ... | 137 | Truck, Capacity of a C. G. R. ... | 199 |
| Tolmifera Pereira ... | 28 | Trypanosomiasis ... | 353 |
| Tolol ... | 31 | Tumbler, Capacity of ... | 8 |
| Ton, Equivalent of Shipping ... | 138 | Turbines ... | 47, 51 |
| " Number of Cubic Feet ... | | Turks and Caicos Islands, ... | |
| in, of various Soils ... | 7 | Duties on Tea at ... | 137 |
| Tonga, Duties on Tea at ... | 137 | Ubberiya ... | 31 |
| Tool Dressed Masonry, Cost of ... | 61 | Uganda, Duties on Tea at ... | 137 |
| Toothache ... | 295 | Ulalu ... | 32 |
| Toon ... | 28 | Ulcers ... | 278 |
| Topping Tea Bushes ... | 95 | Umkannu ... | 32 |
| To Users of Tea ... | 125 | Umbrella Pruning ... | 100 |
| Towenna ... | 31 | Uncinariasis ... | 255 |
| Trailing Side branches Useless ... | 100 | Uncultivated Soils, Moisture in ... | 238 |
| Transmitting H. P. by Belting ... | 39 | Undecorticated Rubber Seed, ... | |
| Transport Baskets ... | 113 | Cost of ... | 165 |
| " by Padda Boats ... | 92 | Unhooped Tea Chests, Rules re ... | |
| " Cost of ... | 78, 92 | Conveyance by Rail of ... | 80 |
| " of Latex ... | 189 | United Kingdom, Duties on ... | |
| " of Tea, Cost of ... | 91 | Tea at ... | 137 |
| " Tea Leaf ... | 120 | " States of America, Du- ... | |
| Transplanting Coconuts ... | 141 | ties on Tea at ... | 137 |
| Transvaal, Duties on Tea at ... | 137 | Unit of Force Defined ... | 2 |
| Treasure Trove Ordinance ... | 407 | Unoccupied Lands Ordinance ... | 407 |
| Treatment of Anchylostomiasis ... | 259 | Unofficial Police Magistrates ... | 405 |
| " " Cattle Disease ... | 350 | | |

| | PAGE | | PAGE |
|----------------------------------|-------------|--------------------------------|---------------|
| Unwrought Timber, Rules re | | Visitor, Duties and Power of | |
| Conveyance by Rail of | 80 | Hospital | 308 |
| Upholstered Furniture, | | Vitality Predisposing Disease, | |
| Poochie in | 38 | Want of | 100 |
| Upkeep of Tea Nursery for | 9 | Vitex Altissima | 30 |
| Months | 105 | Voeten, Dutch Measure | 12 |
| Uruguay, Duties on Tea at | 167 | Vulcanisation Tests | 210 |
| Urukanu | 32 | " Summary of | 214 |
| Use of Saw and Tar in Pruning | 99 | " Time of... | 212 |
| Useful Drugs for Estate use | 293 | | |
| Memoranda | 21 | Wa | 28 |
| Notes, Estate Labourers | 277 | Wages of Labourers, How | |
| Weights | 58 | Payable | 408, 418, 419 |
| Users of Tea, To | 125 | Wagon, Capacity of a Railway | 199 |
| Ustulina Zonata | 224 | Wal-billin | 32 |
| Utensils for Latex, Best | 188 | Wal-burnta | 31 |
| | | Wal-gonna | 32 |
| " V " Notch Weir Table | 43 | Walker & Greig Engines | 50, 51 |
| Vaccination, Concerning | 334 | Walker, Sons & Co., | |
| Directions for | 327 | Engines | 50, 51 |
| Exemptions | 326 | Walls, Cost of | 75 |
| Offences | 272, 331 | Foundations of | 53 |
| Ordinance | 407 | Lime Plaster to | 57 |
| When Imperative | 324 | Stone Grey Wash for | 37 |
| Vaccinator, Duties of | 324 | Thickness of Brick | 53 |
| Vaccine Regulations | 323 | Walnut Stain for Wood | 59 |
| Vade Mecum, Planters' | 124 | Walsura Piscidia | 30 |
| Value of Green Tea Leaf | 116 | Walukena | 31 |
| Tea | 118 | Wanamit | 31 |
| Teas, Equivalent | 118 | Wana-Sapu | 31 |
| Valve, Safety | 448 | Wannaidala | 33 |
| Vapour, Saturated Mixture of | 121 | Want of Vitality Predisposing | |
| Varnish for Woods | 38 | Disease | 100 |
| Varying Capitals of Rubber | | Wants Committee, Medical | 302 |
| per acre | 177 | Ordinance, Medical | 297, 407 |
| Tea per acre | 114 | Warrants | 337, 403 |
| Profits of Rubber | | for Insurance Policies | 337 |
| per lb. | 177 | Wash, Stone Grey for Walls | 37 |
| T ₄ per lb. | 114 | To make Black... | 295 |
| Yields of Rubber | 177 | Wasps and Bees, Stings of | 293 |
| T ₄ | 114 | Waste, Forest, Chenn, Ordin- | |
| Vateria Acum. | 28 | ance | 407 |
| Vatica Roxburghiana | 30 | Water, Boiling Point of | 10 |
| Velocity | 1 | Flowing in Stream, Mea- | |
| of Periphery | 45 | asuring | 42 |
| Venesta Cases | 73 | from Wells, Raising | 46 |
| Rubber Cases | 196 | Gauges, Care of | 448 |
| Packages | 73, 73, 196 | Hard and Soft | 34 |
| Ventilators | 65 | Hycinch not to be | |
| Venezuela, Duties on Tea at | 137 | Imported | 439 |
| Verbal Contract, Definition | | in Latex Cups | 189 |
| of | 408, 420 | Lime, To make... | 295 |
| Veterinary, Duties of | 441 | Melons | 254 |
| Victoria, Duties on Tea at | 137 | on Cuts | 189 |
| Virgin Islands, Duties on Tea at | 137 | Salt | 35 |

INDEX

xlv

| | PAGE | | PAGE |
|--------------------------------|------------|-----------------------------------|----------|
| Water, Soft and Hard... | 34 | Wood, Dry Zone | 33 |
| " Turbines | 46, 51 | " Floors, Cost of | 63 |
| " Weight of | 10 | " Fuel, Consumption of | 69 |
| " Wheels | 46, 47, 48 | " for Tea Factories | 69 |
| Wattles | 28 | " Paint required for | 36 |
| Weather Boarding, Cost of | 64 | " Pecker not to be Ex- | |
| " Nails for | 64 | ported | 436 |
| Weeding Coconuts | 143 | " Roofs | 59 |
| " Tea | 90 | " Stains | 59 |
| Weighing Tea | 126 | " To Kill Knots in | 36 |
| Weight of Charcoal | 32 | " Varnish for | 38 |
| Weights and Measures | 8 | " Wet Zone | 33 |
| " of Materials | 9 | " Work | 58 |
| " Substances | 9 | Wooden Floors, Cost of | 63 |
| " Useful | 58 | Woods, Dry and Intermediate | |
| Weir Tables, Lefel's | 46 | " Zone | 33 |
| " "V" Notch | 43 | " Wet Zone | 33 |
| Welding, Oxy-acetylene | 51 | Work, How to Measure Earth | 14 |
| Welidamba | 31 | " of a Cooly, Average | 161 |
| Welipianna | 31 | Working Rubber, Amount of | 191 |
| Wells, Raising Water from | 46 | Works, Opening Rubber | 154 |
| Welsh Coal, Weight of | 9 | " per acre of Tea, | |
| " Fire Bricks, Dimensions | 52 | Cost of | 89 |
| Weralu | 31 | World, Duties on Tea | 135 |
| West Australia, Duties on | | Wormia Triquet | 29 |
| " Tea at | 137 | Worms in Horses | 367 |
| Westinghouse Engines | 50 | " Medical Treatment | 278, 295 |
| " Turbine... | 50 | Worn parts of Rubber | |
| Wet Measure, Southern | | " Machinery | 194 |
| " Province | 12 | Wounds and Treatment | 292 |
| " Zone Woods | 33 | " Gunshot | 293 |
| Wheels, Water | 46 | " of Dogs | 363 |
| Whelping Dogs | 361 | Writing Cheques | 377 |
| White-fly Beetle Pest | 148 | Wrought Iron, Cubic inches to | |
| White Washing, Cost of | 64 | " cwt. | 11 |
| Whole Leaf Plucking | 101 | Wroy, L. Remarks by | 172 |
| Width of Belting required | 39 | Yaakhalu | 31 |
| Will and Testamentary Disposi- | | Yard, Equivalent Measure | 13 |
| " tions Ordinance | 407 | Yards, Metres in a | 8 |
| Window and Door Frames, | | Yield at Long intervals, | |
| " Teakwood | 65 | " Increased | 165 |
| Wine Glass, Capacity of | 8 | " per Acre of Tea, Profit of | 114 |
| Wira | 31 | " of Rubber, | |
| Wire Shoot Ropes and Acces- | | " Pr fit of | 174 |
| " sories | 71 | " of Rubber, | |
| " " and Winches | 71 | " ascertaining | 175 |
| " " Runners | 71 | "Young Person" Defined | 442 |
| " Shoots | 71 | Zanzibar, Duties on Tea at | 137 |
| Withering Tea, Fans for | 122 | Zero, Equivalents | 10 |
| " Leaf | 121 | Zinc Roofs, Leaks in | 35 |
| Witnesses and Jurors | 404 | " Sulphate of, Its Uses | 295 |
| " Attending Supreme | | " Weight of | 9 |
| " Court | 404 | Zonata, Utulina | 224 |
| "Woman" Defined | 442 | | |
| Wood and Coal | 70 | | |

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